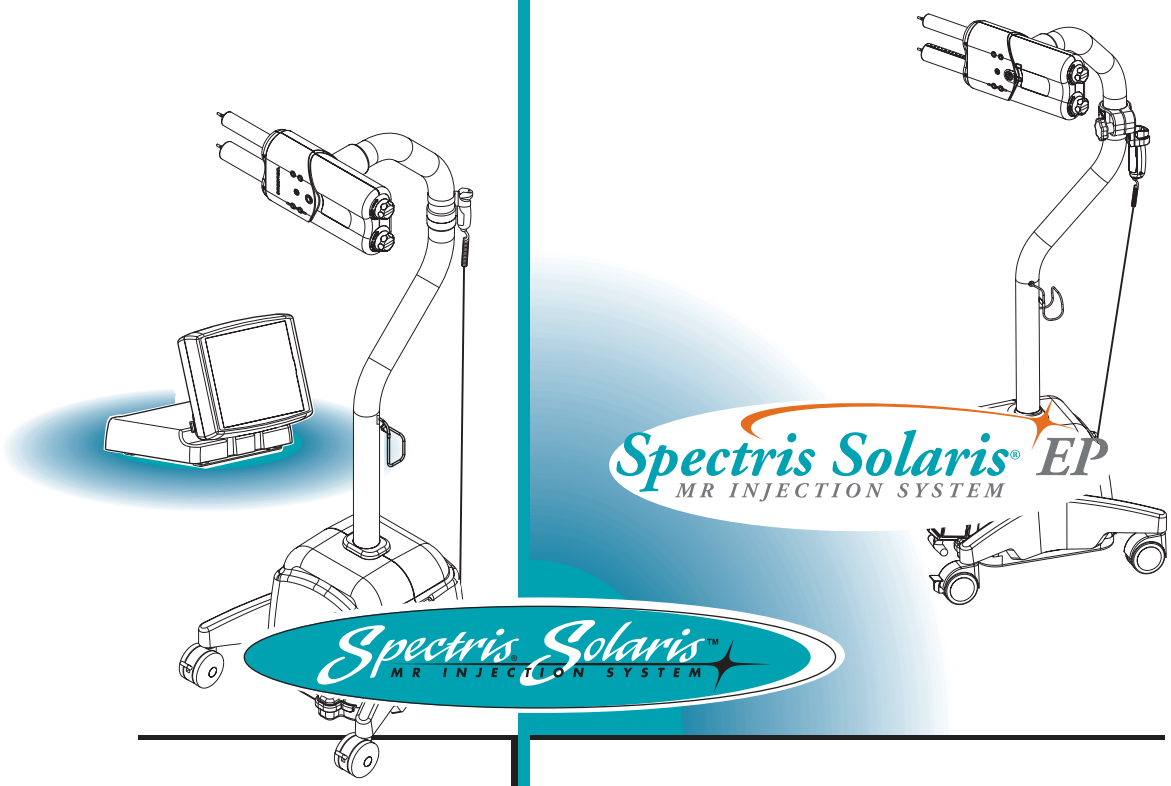
MEDRAD®

Spectris Solaris®
or
Spectris Solaris® EP

MR Injection System
Service Manual

SSMR-SERV



200880 REV. D

Serial numbers and date of installation information must be supplied when ordering replacement parts, or inquiring about servicing. For convenience, record the following information below:

OWNER:	
DATE INSTALLED:	
INJECTOR HEAD SERIAL NUMBER:	
CONTROL ROOM UNIT SERIAL NUMBER:	

The information and specifications included in this publication were in effect at the time of approval for printing. MEDRAD, reserves the right, however, to discontinue or otherwise change specifications or design at anytime without notice, and without incurring any obligation whatsoever.

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1 Introduction

Trademarks

MEDRAD Spectris Solaris®, Spectris Solaris® EP, Qwik-Fit Syringe®, FluiDot®, Quality for Life®, and MEDRAD® are registered trademarks of MEDRAD Incorporated.

Restricted Sale

Federal (U.S.A.) law restricts the sale of this device on or by the order of a physician.

Disclaimers

MEDRAD makes no warranties on the contents of this manual, and specifically disclaims any implied warranties of merchantability or fitness for any purpose.

MEDRAD reserves the right to change specifications and the contents of this manual without obligation.

External wiring modification disclaimer: MEDRAD disclaims liability for any modifications or interfaces with other equipment which are not in conformity with the specifications and information contained within this manual. Such unauthorized action could jeopardize injector operation, safety, or reliability.S
Accessory equipment connected to the MEDRAD Spectris Solaris or Spectris Solaris EP MR Injector must be certified according to IEC 60601-1 standards. Furthermore, all configurations shall comply with the system standard IEC 60601-1-1. Anyone who connects additional equipment to the signal input or output, configures a medical system, and is therefore responsible that the system complies with the requirements of the system standard IEC 60601-1-1. To obtain on-site consulting or consulting references, contact MEDRAD Service.

All drawings in this manual are for reference purposes only, and may not reflect the construction of units produced prior to the publication of this manual. Reproduction quality of these drawings may have been effected by the level of reduction required. Call MEDRAD Service if assistance in drawing interpretation is required.

The *Spectris Solaris or Spectris Solaris EP* Injector is not for portable use.

Problems or Questions

If you experience problems with the *MEDRAD Spectris Solaris or Spectris Solaris EP MR* System, contact your MEDRAD authorized dealer or:

MEDRAD Service
One Medrad Drive
Indianola, PA 15051-0780
USA
Phone: 1-412-767-2400
1-800-MEDRAD-S
1-800-633-7237
FAX: 1-412-767-4126

MEDRAD EUROPE B.V.
Postbus 205
6190 AE Beek
The Netherlands
Phone: (31) (0) 43 3585601
FAX: (31) (0) 43 3656598

Nihon MEDRAD K.K.
9F Central Shin-Osaka Building
4-5-36 Miyahara
Yodogawa-ku
Osaka, 532-0003
Japan
Phone: 81-6-6350-0680
Fax: 81-6-6398-0670

Applicability

This manual applies to the *MEDRAD Spectris Solaris or Spectris Solaris EP MR* Injection System.

Purpose

The purpose of this manual is intended to provide instructions for servicing the *MEDRAD Spectris Solaris or Spectris Solaris EP MR* Injection System safely and accurately. It is intended for those qualified to service the injection system, whether they be MEDRAD Service Personnel, Certified Laboratory Service Technicians or MEDRAD authorized international dealers.

Important Safety Notice

The information in this manual is intended for people with adequate backgrounds and experience in electronics and electromechanical devices. Any attempt to repair a sophisticated medical device such as the injector may result in personal injury, property damage, or patient injury.

Intended Use

This system is intended for the purposes of injecting intravenous MR contrast media and common flushing solutions into the human vascular system for diagnostic studies in magnetic resonance imaging (MRI) procedures.

Certifications

MEDRAD Spectris Solaris or Spectris Solaris EP MR Injection Systems are equipped to operate at 100 - 240 VAC, 50/60 Hz, and designed to be in compliance with EN 60601 -1 (Safety), and EN 60601-1-2 (EMC/Emissions).

MEDRAD, Inc. is EN-ISO 9001/EN 13485 certified.

MEDRAD Europe B.V. is EN-ISO 9002/EN 13488 certified. (European Medical Device Directive 93/42/EEC).

Nihon MEDRAD KK is ISO 9001/ISO 13485 certified.

Additional Information Regarding Compliance to IEC 60601-1-2 / 2001 2nd Edition

This section is intended to reflect conformance to IEC-60601-1-2 / 2001 2nd edition Standards.

⚠ Cautions

The following statements are cautions. Cautions advise of circumstances that could result in damage to the device. Read and understand these cautions before operating the injector system.

Injector may disarm or fail to operate when exposed to high magnetic fields. Portable and mobile RF communications equipment can affect the injector.

FOR PROPER OPERATION, use only accessories and options provided by MEDRAD that are designed specifically for the injector system. Other non-MEDRAD approved accessories or options may cause equipment damage or may result in increased emissions or decreased immunity of the injector system. Injector system accessories listed in it's operation manual comply with the requirements of electromagnetic emissions and immunity standards IEC-60601-1-2 / 2001 2nd edition.

DO NOT USE INJECTOR ADJACENT TO OR STACKED WITH OTHER EQUIPMENT. If adjacent or stacked use is necessary, the injector should be observed to verify normal operation in the configuration in which it will be used.

Recommended separation distances between portable and mobile RF communications equipment and the injector

The injector is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the injector can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the injector as recommended below, according to the maximum output power of the communications equipment.

Rated maximum output power of transmitter W	**Separation distance according to frequency of transmitter m**		
	150 KHz to 80 MHz $d = [3.5/V_1]\ \sqrt{p}$	**80 MHz to 800 MHz** $d = [3.5/E_1]\ \sqrt{p}$	**800 MHz to 2.5 GHz** $d = [7/E_1]\ \sqrt{p}$
0.01	0.12	0.12	0.23
0.1	0.37	0.37	0.74
1	1.17	1.17	2.33
10	3.69	3.69	7.38
100	11.67	11.67	23.33

For transmitters rated at a maximum output power not listed above, the recommended separation distance *d* in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where *p* is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

NOTE 1 At 80 MHz and 800 MHz, the separation distance for the higher frequency applies.

NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

INJECTOR REQUIRES SPECIAL PRECAUTIONS REGARDING EMC. Install and put into service according to the EMC information provided below:

Guidance and manufacturer's declaration - electromagnetic emissions		
The injector is intended for use in the electromagnetic environment specified below. The customer or user of the injector should assure that it is used in such an environment.		
Emissions test	**Compliance**	**Electromagnetic environment - guidance**
RF emissions CISPR 11	Group 1	The injector uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class B Spectris Solaris or Spectris Solaris EP	The injector is suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Class B Spectris Solaris or Spectris Solaris EP	
Voltage fluctuations/flicker emissions IEC 61000-3-3	Complies	

Guidance and manufacturer's declaration - electromagnetic immunity			
The injector is intended for use in the electromagnetic environment specified below. The customer or user of the injector should assure that it is used in such an environment.			
Immunity test	**IEC 60601 test level**	**Compliance level**	**Electromagnetic environment - guidance**
Electrostatic discharge (ESD) IEC 61000-4-2	±6 kV contact ±8 kV air	±6 kV contact ±8 kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with a synthetic material, the relative humidity should be at least 30%.
Electrical/fast transient/ burst IEC 61000-4-4	±2 kV for power supply lines ±1 kV for input/output lines	±2 kV for power supply lines ±1 kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	±1 kV differential mode ±2 kV common mode	±1 kV differential mode ±2 kV common mode	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	<5% U_T (>95% dip in U_T) for 0.5 cycle 40% U_T (60% dip in U_T) for 5 cycles 70% U_T (30% dip in U_T) for 25 cycles <5% U_T (>95% dip in U_T) for 5 sec	<5% U_T (>95% dip in U_T) for 0.5 cycle 40% U_T (60% dip in U_T) for 5 cycles 70% U_T (30% dip in U_T) for 25 cycles <5% U_T (>95% dip in U_T) for 5 sec	Mains power quality should be that of a typical commercial or hospital environment. If the user of the injector requires continuous operation during power mains interruptions, it is recommended the injector be powered from an uninterruptible power supply or battery.
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.

Guidance and manufacturer's declaration - electromagnetic immunity
NOTE U_T is the a.c. mains voltage prior to application of the test level.

Guidance and manufacturer's declaration - electromagnetic immunity			
The injector is intended for use in the electromagnetic environment specified below. The customer or user of the injector should assure that it is used in such an environment.			
Immunity test	**IEC 60601 test level**	**Compliance level**	**Electromagnetic environment - guidance**
Conducted RF IEC-61000-4-6	3 V_{rms} 150 kHz to 80 MHz	3 V_{rms}	Portable and mobile RF communications equipment should be used no closer to any part of the injector, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. **Recommended separation distance** $d = 1.17 \sqrt{p}$
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2.5 GHz	3 V/m	$d = 1.17 \sqrt{p}$ 80 MHz to 800 MHz $d = 2.33 \sqrt{p}$ 800 MHz to 2.5 GHz Where p is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey,[a] should be less than the compliance level in each frequency range.[b] Interference may occur in the vicinity of equipment marked with the following symbol: 
NOTE 1 At 80 MHz and 800 MHz, the higher frequency range applies. NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.			
a Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the injector is used exceeds the applicable RF compliance level above, the injector should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the injector. b Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.			

Symbols and Descriptions

The following international symbols are used on the *MEDRAD Spectris Solaris or Spectris Solaris EP MR* Injector and throughout this manual.

Attention, consult accompanying instructions.

Indicates that this device conforms to the requirements of the European Medical Device Directive 93/42/EEC.

Indicates on/off switch for the Control Room Unit.

Indicates hazardous voltages.

Indicates alternating current.

Identifies a type BF applied part complying with EN 60601-1 standards.

CLASS 1

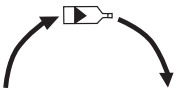
Indicates the injection system is Class 1 medical equipment as defined by EN 60601-1 standards.

IPX1

Identifies the degree of protection against fluid as drip proof.

Identifies connection of the handswitch.

Identifies injector head forward and reverse piston control keys.



Identifies the direction of manual knob rotation relative to plunger movement.

Identifies the ENABLE key.

\- + -

Identifies polarity of the battery pack terminals.

Indicates the current charge level of the system battery.

Indicates the AIR EXPELLED button on the injector head. When illuminated yellow on the touch screen, also indicates that the operator has acknowledged inspecting the fluid path for air.

Identifies the Equipotential connection.

Identifies the Earth Ground point.

Identifies the Service Connection Port.

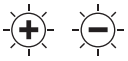
TX Identifies the Communication Cable Transmit connection.

RX Identifies the Communication Cable Receive connection.

Indicates design for indoor use only.

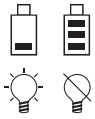
Indicates the presence of no serviceable parts.

Indicates the presence of AC power at the battery charger.

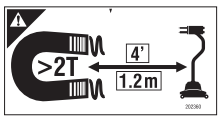


Identifies the Control Room Unit brightness controls.

P109 *Reserved for future use.*



Indicates the status of the battery charger. When a battery is properly inserted, the LED will illuminate while charging, and extinguish when the battery is fully charged.



Identifies the distance that the injector must be placed in relation to the magnet bore with a field strength greater than 2T.

Identifies Integrated Continuous Battery Charger system activity on Graphical User Interface. When illuminated yellow this indicates that the Continuous Battery Charger system is present and functioning.

INTRODUCTION TO
WARNINGS / CAUTIONS

This manual contains important information about safe servicing of the *MEDRAD Spectris Solaris or Spectris Solaris EP MR* Injection System.

MEDRAD urges the service technician to read this manual carefully, become familiar with the procedures and system functions that it describes, and follow its recommendations to assure proper servicing of the system.

Warning labels on the *MEDRAD Spectris Solaris or Spectris Solaris EP MR* system or Warning statements in this manual preceeded by any of the following words and/or symbols are of special significance:

WARNING: Indicates a potentially hazardous situation. If not avoided, this could result in death or serious injury.

WARNING: Indicates electrical hazards which could result in death or serious injury.

CAUTION: Indicates potential hazards or unsafe practices which could cause product, system, or property damage.

NOTE: Indicates helpful information is being offered.

WARNINGS

Injury may result from exposure to hazardous voltages existing within the system. The system should be opened and serviced by qualified service personnel only. Disconnect the system from line power before cleaning or attempting to perform any maintenance.

Explosion hazard in the presence of flammables. Do not use the system in the presence of anesthetic gases and equipment.

Patient or operator injury can occur from use of worn power cords or control cables. Examine power cords and cables for cuts, frays, or any other visible damage. Do not use the system if any of the cords or cables show signs of damage. Any damaged or worn connection cables or power cords should be replaced.

Unsafe operation may result from using improper accessories and replacement parts. Use only accessories, options, and parts designed for this system, and provided by MEDRAD,

Fire hazard: to avoid an electrical fire, assure the correct type of fuse is used for replacement. The fuse must be replaced with type F, 250V, 2.5 A fuse by qualified personnel only.

Chemical burn hazard: Always carry the battery pack firmly by the battery pack hand grip. Damage to the housing may result in a chemical burn hazard. Do not use if the housing is severely cracked or damaged.

Improper disposal of the battery pack may result in explosion, leakage, or personal injury. Do not open, or dispose, in a fire! Follow all local regulations concerning the disposal of spent lead-acid based batteries, or contact MEDRAD for assistance.

CAUTIONS

Damage may occur as a result of failure to follow electrostatic discharge (ESD) protection practices. ESD protection practices must be followed when servicing any component of this system.

Damage can occur as a result of incorrect voltages. Check the voltage and frequency marked on the back of the Power Supply. Ensure that the outlet providing power to the injector supplies a voltage, frequency, and volt-ampere rating within the range specified on the unit.

Environmental damage may result from improper disposal of system components or accessories. Electronic assemblies contain potentially hazardous materials. Follow all local regulations for the recycling or disposal of electronic assemblies, or contact MEDRAD Service for assistance.

Damage can occur as a result of abrupt interruption or application of supplies. To avoid damage to sensitive circuits on the boards, disconnect the power cord before removing or replacing PC boards.

Allow system temperature to stabilize before use. To avoid damage to sensitive electronic circuits, allow the system to stabilize to room temperature before servicing when exposed to extreme temperature changes.

Perform regular preventive maintenance. To ensure that your *MEDRAD Spectris Solaris or Spectris Solaris EP* System remains properly calibrated, and that all primary and backup circuits are functioning properly, regular preventive maintenance is recommended. An annual preventive maintenance package is not included in the new machine warranty. Contact your local MEDRAD Service Representative for details.

Damage may result from improper or careless cleaning methods. While cleaning any outside portion of the system, avoid allowing any water to seep inside system components.

NOTE: All relevant guidelines for institutional, local, or national safety recommendations related to cable routing and installation should be followed.

2 Maintenance and Checkout

This section contains recommended procedures for maintenance, and an operational checkout of the *MEDRAD Spectris Solaris or Spectris Solaris EP MR Injection System.* Routine maintenance and inspection will:

- Ensure continued performance of the injection system
- Reduce the possibility of equipment malfunction

Recommended Maintenance Schedule

Your *MEDRAD Spectris Solaris or Spectris Solaris EP MR Injection System* must be properly maintained to ensure that it is in peak operating condition. Your individual maintenance system and schedule depends upon how your injection system is used, the type of procedures performed, and frequency of use. The following maintenance schedule is recommended for the system:

Daily:
The piston rod should be thoroughly cleaned after each use. Before use each day, the system should be cleaned and inspected, using the procedures outlined in this section. Ensure that all system safety and warning labels are in place and are legible.

Monthly:
Once a month, the entire system should be thoroughly inspected and cleaned, and an Operational Checkout should be performed.

Annually:
As part of an annual maintenance program performed by a qualified MEDRAD Service Representative or authorized dealer, both Electrical Leakage and Ground Continuity checks should be performed.

NOTE: Local regulations or hospital protocol may require electrical leakage checks at more frequent intervals. If this applies, local regulations for leakage must be followed.

MEDRAD also recommends that a complete system calibration and performance checkout be performed annually. Contact MEDRAD Factory Service, or your local MEDRAD office for complete details.

In the United States, Canada, Japan, and Europe, the MEDRAD Service Department offers Preventive Maintenance Programs. These annual programs greatly assist in maintaining accuracy and reliability, and can also extend the life of the system. Contact MEDRAD for details. In Europe, contact your local MEDRAD office or your local authorized dealer for further information. Refer to the back of the title page of this manual for address, telephone and FAX information.

NOTE: Failures which occur due to lack of proper maintenance will not be covered under warranty.

MEDRAD Service

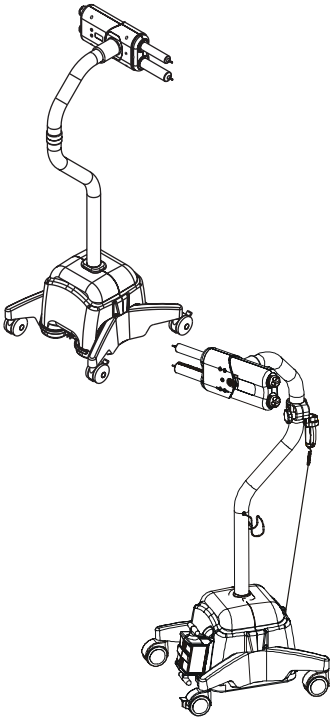
MEDRAD Service will make available upon request:

- Circuit diagrams, component parts lists, or other information that will assist qualified technicians to repair components classified as repairable.
- On-site consulting or consulting references.

Inspection Procedures

The following procedures are recommended for *daily* inspection of all components in the *MEDRAD Spectris Solaris or Spectris Solaris EP MR Injection* System. If any defects are detected, either repair the system, or call MEDRAD for service. Do not use the system until the problem is corrected.

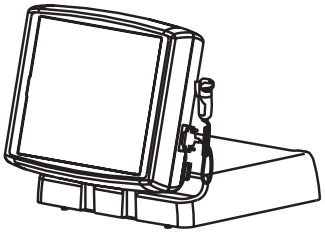
Scan Room Unit



1. Inspect the housing for any damage or cracks that could allow fluid to leak inside, or weaken the structural integrity of the unit.
2. Inspect *all* cables connected to the unit: Look for cuts, cracks, worn spots or other obvious damage to the cables. Ensure that all connectors are properly seated.
3. Inspect for contrast media build-up in the syringe interface area. Follow the cleaning guidelines outlined in this section.
4. Inspect the stand, base, and support arm for cracks and other defects that could weaken the structure.
5. Ensure that all mounting bolts and screws are secure.
6. Ensure that all locking mechanisms on the casters are functional.
7. Inspect the pivot points. The head and support arm must pivot freely. The injector head should rotate on the support arm no more than 330^{o}. The support arm should not rotate on the center post more than 350^{o}.

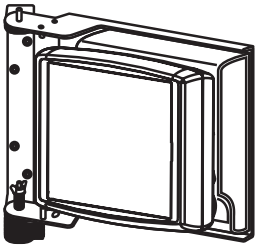
NOTE: All relevant guidelines for institutional, local, or national safety recommendations related to cable routing and installation should be followed.

Control Room Unit



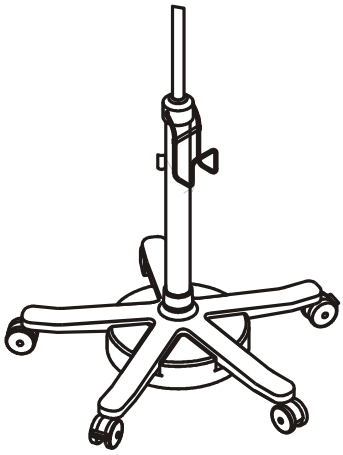
1. Inspect *all* cables connected to the unit: Look for cuts, cracks, or worn spots, or other obvious damage. Ensure that all connectors are properly seated.
2. Inspect the housing for any damage or cracks that could allow fluid to leak inside, or weaken the structural integrity of the unit.

Wall Bracket



1. Inspect all parts of the bracket for cracks and other defects that would weaken the assembly.
2. Ensure that the bracket is securely attached to the wall.
3. Ensure that all cables are secured to the display control unit and do not interfere with the movement of the mounting bracket.

Control Room Pedestal

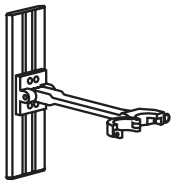


1. Inspect the stand, base and support arm for cracks and other defects that could weaken the structure.
2. Ensure all mounting bolts and screws are secure.
3. Ensure that the casters roll smoothly with no binding or scraping.
4. Ensure all locking mechanisms on the casters are functional.
5. Verify that the vertical height adjustment of the column shaft moves freely without binding or scraping.

Battery Charger

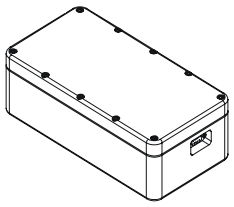
1. Inspect *all* cables connected to the unit: Look for cuts, cracks, or worn spots, or other obvious damage. Ensure that all connectors are properly seated.
2. Inspect the housing for any damage or cracks that could allow fluid to leak inside, or weaken the structural integrity of the unit.
3. Inspect all parts of the wall mounting bracket for cracks or other defects that would weaken the assembly. If applicable, ensure that the bracket remains firmly attached to the wall.

Mobile Mount



1. Inspect the bracket for cracks and other defects that would weaken the structure.
2. Insure all mounting bolts and screws are secure.
3. Ensure locking mechanism on bracket is functional.
4. Ensure head pad is secured to wall and straps are present and functional.

Continuous Battery Charger



1. Inspect all cable connected to the unit: Look for cuts, cracks, worn spots, or obvious damage. Ensure that all connectors are properly sealed.
2. Ensure ferrite clamps are present and secured to cable with cable tie.
3. Inspect the housing of the charger and battery for damage or cracks that would allow fluid to leak inside or weaken the structural integrity of the unit.

Electrical Leakage Check

To ensure safe operation of the *MEDRAD Spectris Solaris or Spectris Solaris EP* Injection System, an electrical leakage check must be part of regular maintenance.

Use a commercial leakage tester such as one of the following:

MANUFACTURER	MODEL
Bio-Tek Instruments, Inc. Electrical Safety Analyzer	Model 601 PRO
Bender	Unimet 1000 ST
Bapco	IEC601L
NeTech	LGK 601

1. With the AC ground open, power applied, and the line at normal, leakage should be less than 100 micro amps.
2. With the AC ground open, power applied and the line reversed, leakage should be less than 100 micro amps.
3. Disconnect the leakage test device.

Ground Continuity Check

A ground continuity check must also be part of regular maintenance of the *MEDRAD Spectris Solaris or Spectris Solaris EP* system.

1. Disconnect the system from the power source.
2. Using an ohm meter, measure the resistance between the ground terminal on the power cord and the equipotential connector on the CRU. The resistance measured must be less than 0.2 ohms.

Cleaning and Operational Checkout

Cleaning Guidelines

Deposits of contrast media can interfere with proper operation of the *MEDRAD Spectris Solaris or Spectris Solaris EP MR Injection System*. The following guidelines should be followed when removing deposits, or cleaning any portion of the system.

WARNING: Serious injury or death may result from exposure to hazardous voltages existing within the system. Disconnect the system from line power before cleaning or attempting to perform any maintenance. Ensure that the system is completely dry before connecting to the power source and applying power.

CAUTION: Improper or careless cleaning methods may result in equipment damage. Do not soak or immerse any part of the injection system in water. While cleaning any outside portion of the system, avoid allowing any water to leak inside system components.

- If contrast medium has leaked inside any component of the system, the affected subassembly should be disassembled and cleaned. This cleaning procedure can be done in the field by trained MEDRAD Service personnel, or returned to MEDRAD Service.

- Care must be taken not to get water or cleaning solutions inside any system components. Do not use strong industrial cleaning agents or solvents such as acetone. Warm water and a mild disinfectant such as antibacterial hand soap are all that is required.

- To clean the syringe interface area of the injector head, fully retract the piston. Using a paper towel moistened with warm water or a mild disinfectant, gently wipe the inner syringe installation area. Do not insert any sharp instruments into this area during the cleaning process.

Operational Checkout

A basic functional checkout of the *MEDRAD Spectris Solaris or Spectris Solaris EP MR Injection System* should be included as part of regular maintenance. Verifying proper operation of the injection system will help in detection of any problems that may not be noticed in day to day operation. The following procedure represents a suggested series of activities which encompass typical operation of the system. Read the following procedure carefully before beginning the checkout. If problems are detected, refer to the General Troubleshooting Procedure found in Section 3.

CAUTION: Any problems detected during this or any other procedure should be corrected before using the injection system in patient procedures.

System Labels

Ensure that all system safety and warning labels are in place and legible.

Power Up

Apply power to the system. Verify that the Safety screen is displayed after system diagnostics occur. Press **Continue** to acknowledge the messages on the Safety screen.

Programming

After the Main screen is displayed, verify that the following controls are functioning properly.

At the rear of the Control Room Unit, Press the **Lighten Display Contrast** key until the screen is lightened to its fullest extent. Press the **Darken Display Contrast** Key until the screen is darkened to its fullest extent. Adjust the screen appearance to return to a desirable contrast level.

Fully advance and reverse the pistons by using the ENABLE key and the forward/reverse controls. Verify that both pistons respond to the forward and reverse controls in slow and fast speed.

Enter the following protocol:

		Flow Rate	Volume
Phase 1:	**Syringe A:**	10 ml/s	20 ml
Phase 2:	**Syringe B:**	2.5 ml/s	10 ml
Phase 3:		PAUSE	5 seconds
Phase 4:	**Syringe A:**	5.0 ml/s	10 ml
Phase 5:	**Syringe B:**	0.1 ml/s	1 ml

NOTE: This protocol is entered with **NO DELAY** and **KVO OFF.**

Arm in single injection mode and inject. In one of the phases, activate the **HOLD** feature by pressing the **Start** button for at least 10 seconds.

Verify that the injection completes normally.

When the injection is complete, access the Injection History screen and verify volume accuracy; actual volume and programmed volume should be the same (41 ml).

Add a 15 second inject delay to the program and activate KVO.

Arm in single injection mode and inject.

Verify that:

A. When the handswitch is pressed, the inject delay begins counting down while KVO continues.

B. The inject delay beeps 5 times when the delay timer elapses and that the injection begins automatically at that time.

Verify that when the injection completes, KVO resumes.

Remove power from the system.

3 Troubleshooting

System Malfunction Codes

Conditions can occur which will prevent the injection system from being armed, or even interrupt an injection that is in progress. These conditions may be operator induced or caused by a system malfunction. Error Codes which inform the user of these conditions are displayed on the control panel.

General Troubleshooting Guidelines

Consider the following guidelines before troubleshooting any condition. These guidelines may help in resolving the condition quickly: Remember, try the simple things first.

CAUTION: Damage may occur as a result of failure to follow electrostatic discharge (ESD) protection practices. ESD protection practices must be followed when servicing any component of this system.

CAUTION: Damage could result from improperly handled components. Before touching any of the circuit cards in the system, discharge yourself to grounded metal. If memory components are to be shipped, place the components in conductive carriers (as supplied through MEDRAD).

CAUTION: Disconnect the power cord before removing or replacing PC boards. Sensitive circuits on the boards can be damaged by abrupt interruption or application of supplies.

- Try removing power for one minute. Allow the system to reset completely, then reapply power and retry. The condition could be intermittent, or caused by a voltage transient. If the condition persists, continue troubleshooting.

- To verify the existence of a condition, attempt to recreate the problem. Follow the Checkout Procedure outlined in Section 2 of this manual to check for proper (or improper) operation of the system.

- Some faults can be caused by a noisy electrical environment. If these conditions persist, contact s Factory Service* for further assistance.

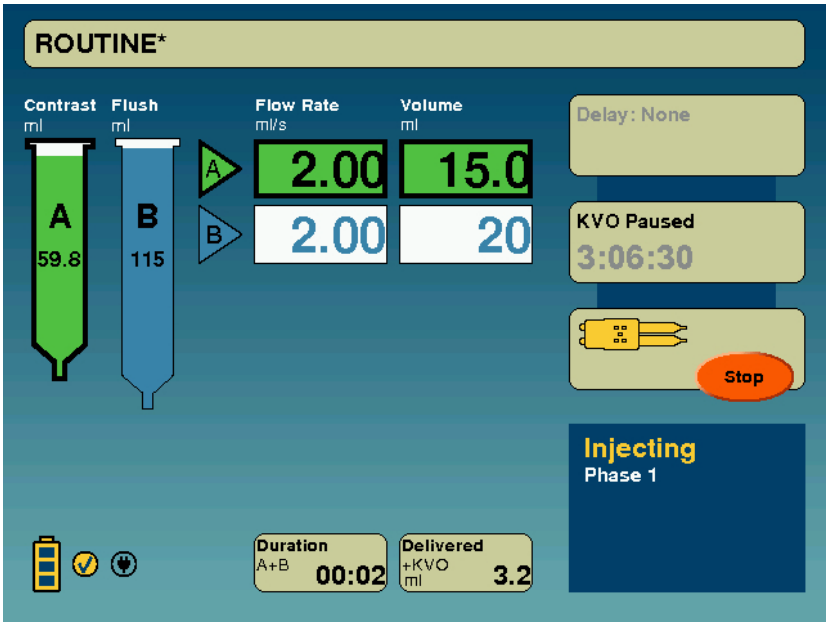
* Indicates contact MEDRAD Factory Service or an Authorized Dealer.

System Messages

The system will display messages on the screen as conditions or events occur. There are three basic types of messages:

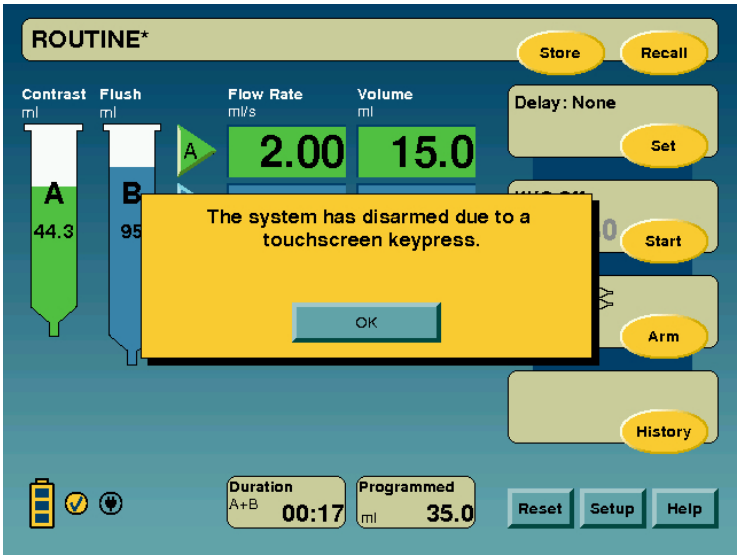
Type 1 Messages

Type 1 messages are messages which provide information regarding the current status of the system, and will clear automatically from the screen. These messages are typically displayed in the lower right corner of the screen.



Type 2 Messages

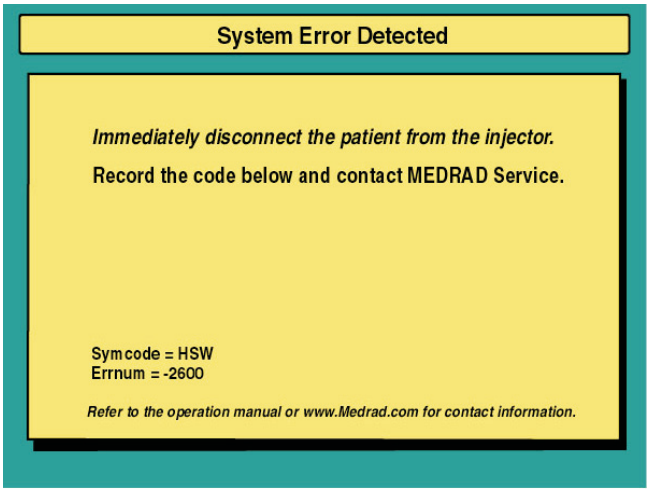
Type 2 messages are messages that convey information that must be explicitly acknowledged before proceeding. The message is displayed within a yellow dialog box - a button (or buttons) must be pressed to acknowledge and remove the message from the screen.



Type 3 Messages

Type 3 messages are system malfunction messages which require power to be removed from the system. Some Type 3 messages provide suggestions to prevent the condition from recurring. If the condition cannot be corrected, record the code and number from the lower left corner of the dialog box, then call MEDRAD Service for assistance.

WARNING: Patient injury may result from a system malfunction. If a system malfunction occurs, immediately remove Scan Room Unit power (by pulling the battery from the head stand), and disconnect the system from the patient. If a fault message is displayed that cannot be corrected, and/or the system is not operating correctly, do not use the injection system. Call MEDRAD for assistance.



Type 3 errors are broken down into categories of function level. Each category is also broken down to specific errors. Below is a list of the categories and suggested repair sequences. Before replacing any parts, cycle power to injector. This will send the system through a self-test process. If the problem is corrected, there was probably a voltage transient in the unit, which is now cleared, enabling use of the system. If the repair sequence does not correct the problem, contact MEDRAD Service or an authorized dealer.

NOTE: Replacement of the Servo/CPU Card and/or the Head mechanical assembly will require recalibration/reverification of potentiometer and pressure.

BATT Battery
Errors with a prefix of BATT mean that the system has found a problem with the Scan Room Unit battery.

- Install a different battery.

CAL Calibration
Errors with a prefix of CAL mean that the system has found an error with the system calibration values missing or corrupt.
Recalibrate system potentiometer and pressure.

- Replace the Servo/CPU Card.

CVD Critical Voltage failure in Control Room Unit
Errors with a prefix of CVD mean that one of the critical voltages in the Control Room Unit is found to be out of specification.

- Verify that all supply voltages are correct.
- Replace the card sourcing the incorrect voltage.

CVH Critical Voltage failure in Scan Room Unit
Errors with a prefix of CVH mean that one of the critical voltages in the Scan Room Unit is found to be out of specification.

- Verify that all supply voltages are correct.
- Replace the card sourcing the incorrect voltage.

ENCA Encoder A
Errors with a prefix of ENCA indicate that the system has found a problem with the Encoder on A motor or the associated circuitry.

- Ensure that P/J 203 is connected correctly onto the Stand Base Interface card.
- Replace the Power Drive card.
- Replace the motor.

ENCB Encoder B

Errors with a prefix of ENCB indicate that the system has found a problem with the Encoder on B motor or the associated circuitry.

- Ensure that P/J 204 is connected correctly onto the Stand base interface card.
- Replace the Power Drive card.
- Replace the motor.

HOVER Switch Card

Errors with a prefix of HOVER indicate that the system has found a problem with the head switch card or the associated circuitry.

- Ensure that there where no switch pressed during power up diagnostic test.
- Ensure that the head cable is seated properly.
- Replace the switch card.
- Replace the Servo/CPU card.

HUB Ethernet Hub

Errors with the prefix HUB, have detected a problem in the Ethernet HUB or the associated circuitry.

- Ensure all cables are fully connected into the HUB (power and communication).
- Replace the HUB.

ICD Interface/Switch Card In DCU

Errors with a prefix of ICD mean that the system has found a problem with the Control Room Unit Interface Card in the DCU top section or the associated circuitry.

- Ensure that the card has all the connectors fully seated.
- Replace the DCU Interface card.
- Replace the SBC card.

ICE Interconnect Card Expansion Base

Errors with a prefix of ICE mean that the system has found a problem with the Expansion Base Interface Card or the associated circuitry.

- Ensure that the card connectors are fully seated.
- Replace the Expansion Base Interface Card.
- Replace the SBC card.

ICS Interface Card In Scan Room Unit

Errors with a prefix of ISC mean that the system has found a problem with the Scan Room Unit Interface Card or the associated circuitry.

- Ensure that the both the Servo/CPU card and the Power Drive card are fully seated into the Stand Base Interface card.
- Card are fully seated into the Stand Base Interface Card.
- Replace the Scan Room Unit Interface Card.
- Replace the Servo/CPU card.

MOTA Motor A

Errors with a prefix of MOTA mean that the system has found a problem with motor A or the associated circuitry during the H Bridge test.

- Ensure that P/J 221 is connected correctly onto the power card.
- Replace the Power Drive card.
- Replace the motor.

MOTB Motor B

Errors with a prefix of MOTB mean that the system has found a problem with motor B or the associated circuitry during the H Bridge test.

- Ensure that P/J 222 is connected correctly onto the power card.
- Replace the Power Drive card.
- Replace the motor.

PCMCIA PCMCIA Card

Errors with a prefix of PCMCIA mean that the system has found a problem with the PCMCIA card or the associated circuitry.

- Remove and re-apply power to the unit. This will trigger a self-test that will attempt to verify proper unit operation. If the problem is corrected, there was probably a voltage transient in the unit, now cleared, enabling system use.
- Ensure that the card is fully seated into the SBC card.
- Replace the PCMCIA card.
- Replace the SBC card.

POTA Pot A

Errors with a prefix of POTA indicate that the system has found a problem with the Potentiometer A or the associated circuitry.

- Remove and re-apply power to the unit. This will trigger a self-test that will attempt to verify proper unit operation. If the problem is corrected, there was probably a voltage transient in the unit, now cleared, enabling system use.
- Ensure that Connector P/J 321 is full seated.
- Ensure that the head cable is fully seated in the head P/J 323 and on the electronic housing at P/J 206.
- Realign potentiometer A. Align wIth gear train and recalibrate.
- Replace Potentiometer A.
- Replace Stand Base Interface Card.
- Replace the Servo/CPU card.

POTB Pot B

Errors with a prefix of POTB indicate that the system has found a problem with Potentiometer B or the associated circuitry.

- Remove and re-apply power to the unit. This will trigger a self-test that will attempt to verify proper unit operation. If the problem is corrected, there was probably a voltage transient in the unit, now cleared, enabling system use.
- Ensure that Connector P/J 322 is full seated.
- Ensure that the head cable is fully seated in the head P/J 323 and on the electronic housing at P/J 206.
- Realign potentiometer A. Align wIth gear train and recalibrate.
- Replace Potentiometer B.
- Replace Stand Base Interface Card.
- Replace the Servo/CPU card.

POWR Power Drive Card

Errors with a prefix of POWR indicate that the system has found a problem with the power card or the associated circuitry.

- Ensure that the card is fully seated into the Stand Base Interface Card.
- Replace the Power Drive card.
- Replace the Servo/CPU Card.

PRSSRA Pressure Transducer A

Errors with a prefix of PRSSRA indicate that the system has found a problem with Pressure Transducer A or the associated circuitry.

- Ensure that the Transducer connector P/J 324 is fully seated.
- Replace the Sensor card.
- Replace the Servo/CPU card.
- Replace the Mechanical Drive assembly.

PRSSRB Pressure Transducer B

Errors with a prefix of PRSSRB indicate that the system has found a problem with the Pressure transducers B-side or the associated circuitry.

- Ensure that the Transducer connector P/J 325 is fully seated.
- Replace the Sensor card.
- Replace the Servo/CPU card.
- Replace the Mechanical Drive assembly.

RATE Over Rate Injection

Errors with a prefix of RATE indicate that the system has detected an over rate condition.

- Ensure potentiometers are fully seated into gears. Replace potentiometer of the side with the problem.
- Replace the motor of the side with the problem.
- Replace the Servo/CPU card.

SBC Single Board Computer (SBC)

Errors with a prefix of SBC indicate that the system has found a problem with the Single Board Computer or the associated circuitry.

- Ensure that the card is has all the connectors fully seated.
- Replace the SBC card.
- Replace the DCU Interface Card.

SER Servo CPU Card

Errors with SER typically indicate a problem with the Servo/CPU Card. This may be a condition that must be corrected, or simply an electrical transient that disrupted the system. Try the following:

- Remove and re-apply power to the unit. This will trigger a self-test that will attempt to verify proper unit operation. If the problem is corrected, there was probably a voltage transient in the unit, now cleared, enabling system use.
- If the problem continues, replace the Servo/CPU card.
- If the condition persists, call MEDRAD Factory Service.

SSD Start Switch (DCU)

Errors with a prefix of SSD typically indicates a problem with the Start Switch. If a Start Switch is not present, contact MEDRAD Service. If one is present, try the following to return the injector to service:

- Check the Start Switch connection at the Control Room Unit to assure the connector is fully seated. If the connection is loose, remove and reattach the connector.
- Cycle power to the unit to reset the system.
- Disconnect the patient and perform a trial injection using the Start Switch. If the system performs correctly, return the system to use.
- If the error reappears, remove the Start Switch.
- Cycle power. If the error goes away, contact MEDRAD Service for a replacement Start Switch.
- If the error persists, contact MEDRAD Service.

SSH Start Switch (Head)

Errors with a prefix of SSH typically indicates a problem with the Start Switch. If a Start Switch is not present, contact MEDRAD Service. If one is present, try the following to return the injector to service:

- Check the start switch connection at the Scan Room Unit to assure the connector is fully seated. If the connection is loose, remove and reattach the connector.
- Cycle power to the unit to reset the system.
- Disconnect the patient and perform a trial injection using the Start Switch. If the system performs correctly, return the system to use.
- If the error reappears, remove the Start Switch.
- Cycle power. If the error goes away, contact MEDRAD Service for a replacement Start Switch.
- If the error persists, contact MEDRAD Service.

SW Software Problem

Errors with SW typically indicate a problem with internal software. This may be a condition that must be corrected, or simply an electrical transient that disrupted the system. Try the following:

- Remove and re-apply power to the unit. This will trigger a self-test that will attempt to verify proper unit operation. If the problem is corrected, there was probably a voltage transient in the unit, now cleared, enabling system use.
- If the problem continues, contact MEDRAD to reload software.
- If the problem continues, replace the Control Room Unit SBC card.
- If the condition persists, call MEDRAD Factory Service.

SWMTCH Software Mismatch

Errors with SWMTCH typically indicate a problem with internal software not matching between the Scan Room Unit and the Control Room Unit. This may be a condition that must be corrected, or simply an electrical transient that disrupted the system. Try the following:

- Remove and re-apply power to the unit. This will trigger a self-test that will attempt to verify proper unit operation. If the problem is corrected, there was probably a voltage transient in the unit, now cleared, enabling system use.
- If the problem continues, contact MEDRAD to reload software.

SYRSENA Size Sensor A

Errors with a prefix of SYRSENA indicate that the system has found a problem with the size sensor on A side or the associated circuitry.

- Ensure that no syringes are on during self test.
- Remove and re-apply power to the unit. This will trigger a self-test that will attempt to verify proper unit operation. If the problem is corrected, there was probably a voltage transient in the unit, now cleared, enabling system use.
- Ensure that P/J 401 is connected correctly to the Syringe Size Detector card and that P/J 327 is correctly connected to the sensor card.
- Replace the Syringe Interface Assembly A. Replace the Servo/CPU card.

SYRSENB Size Sensor B

Errors with a prefix of SYRSENB indicate that the system has found a problem with the size sensor on B side or the associated circuitry.

- Ensure that no syringes are on during self test.
- Remove and re-apply power to the unit. This will trigger a self-test that will attempt to verify proper unit operation. If the problem is corrected, there was probably a voltage transient in the unit, now cleared, enabling system use.
- Ensure that P/J 401 is connected correctly to the Syringe Size Detector card and that P/J 328 is correctly connected to the sensor card.
- Replace the Syringe Interface Assembly B.
- Replace the Servo/CPU card.

TCHSCR Touch Screen

Errors with a prefix of TCHSCR indicate that the system has found a problem with the touch screen or the associated circuitry.

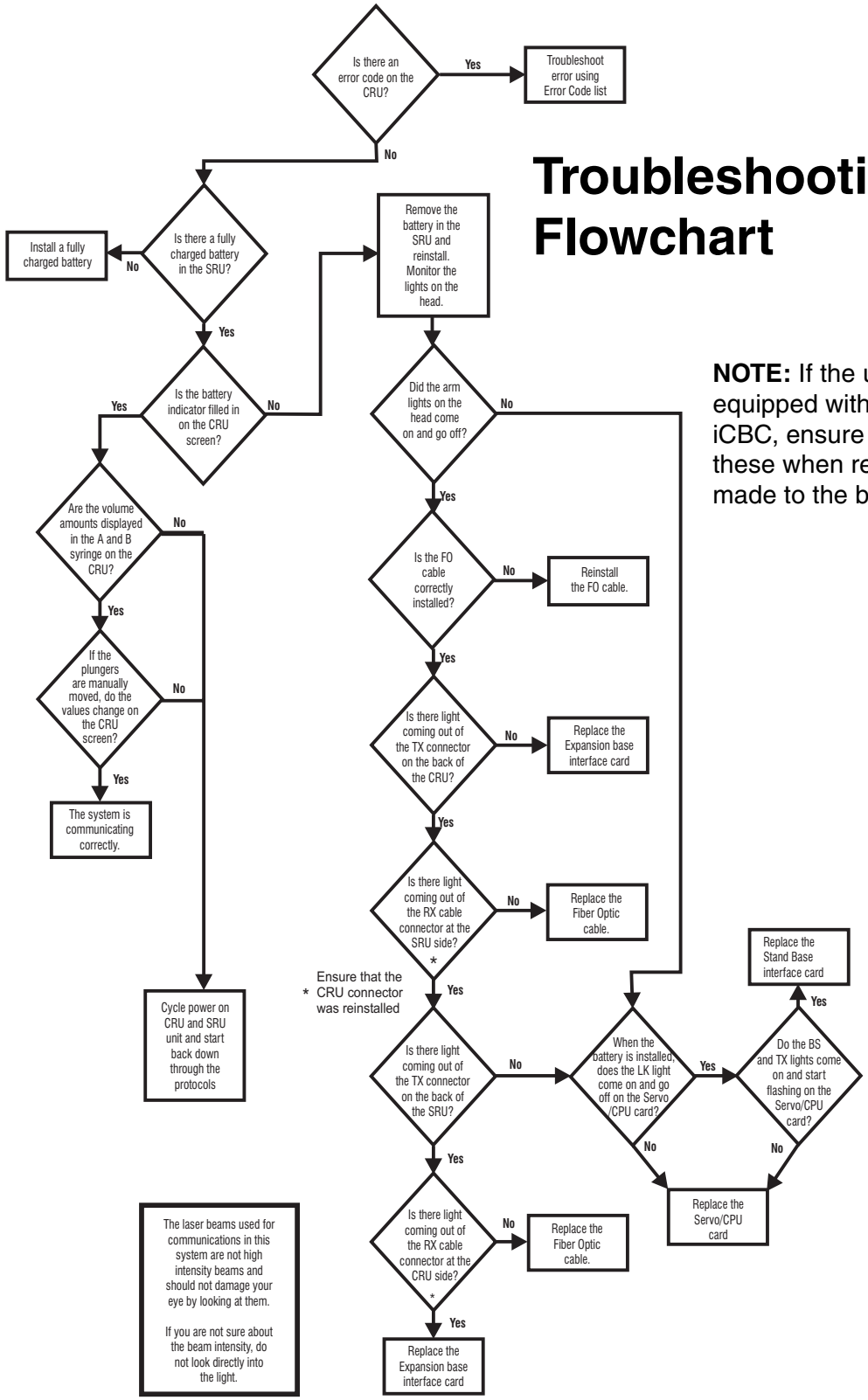
- Ensure that nothing is pressing the touch screen during self test.
- Remove and re-apply power to the unit. This will trigger a self-test that will attempt to verify proper unit operation. If the problem is corrected, there was probably a voltage transient in the unit, now cleared, enabling system use.
- Recalibrate the Touch Screen
- Insure that ribbon and Touch Screen extension cables are connected correctly and that P/J 4 is correctly connected to the SBC card.
- Replace the Touch screen.
- Replace the SBC card.

VOL Over Volume Injection

Errors with a prefix of VOL indicate that the system has detected an over volume condition.

- Ensure potentiometers are fully seated into gears. Replace potentiometer of the side with the problem.
- Replace the motor of the side with the problem.
- Replace the Servo/CPU card.

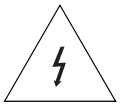
Troubleshooting Flowchart



NOTE: If the unit is equipped with CBC or iCBC, ensure operation of these when references are made to the battery.

4 Disassembly and Reassembly Procedures

This section contains recommended procedures for the disassembly and reassembly of those portions of the injection system that can be readily repaired in the field, along with part numbers and ordering information for field replaceable components. If through troubleshooting and diagnosis, a repair or replacement procedure or component which is not outlined in this section is required, contact MEDRAD Factory Service, or your local MEDRAD Service Representative.



WARNING: Hazardous voltages exist within the *Spectris Solaris* Injection System **that can shock, burn, or cause death. To avoid injury, the system should be opened and serviced by qualified service personnel only. Disconnect the system from line power before cleaning or attempting to perform any maintenance or repairs.**

WARNING: Immediately disconnect the patient from the injector if any system malfunction occurs. If a system malfunction message appears, do not attempt to use the system until the source of the condition has been identified and corrected by qualified service personnel. Do not attempt to recreate any fault conditions while connected to a patient.

CAUTION: Electrostatic Discharge (ESD). Failure to follow ESD protection practices may result in equipment damage. ESD protection practices must be followed when servicing any component of this system.

DCU - ***Touch Screen***

Touch Screen Removal

1. The DCU enclosure consists of two sections. Remove four screws from the back of the DCU enclosure.
2. Separate the two halves.

   NOTE: Cables are connected between the two halves. Use caution when separating the sections.

3. Disconnect P/J 22 (Inverter Power).
4. Disconnect inline connector P/J 5 from the Touch Screen and slide it through the opening in the shield plate
5. Remove two screws form the inverter shield. Remove shield and disconnect the LCD wires.
6. Open the ferrite shield then disconnect the in-line connector P/J5 from the Touch Screen and pass it through the opening in the shield plate. Remove four screws that secure the shield plate to the LCD.
7. Remove the shield plate and LCD panel as one unit - may be difficult.
8. Take caution when separating sections of interconnecting cables, pull gently.
9. Lift the LCD off the Touch Screen and set it on the shield plate - NOT required if removed as one unit.
10. Remove the tape holding the Touch Screen cable to the cover.
11. Carefully push the Touch Screen and overlay through the front bezel. Begin removal by pulling the Touch Screen/Overlay from the corner. Remove any remaining adhesive.

DCU - *Touch Screen (continued)*

Touch Screen Replacement

1. Place the Touch Screen and overlay into the front bezel. Install product label.
2. Install new copper tape to secure the Touch Screen cable to the cover.
3. Replace the plastic mylar shield.
4. Ensure mylar shield is secured and set the LCD and shield plate the bezel all the way to the side with the Touch Screen cable.

   NOTE: Ensure that LCD power cables that pass through the notch do not become pinched.

5. Route the LCD cable through the hole in the shield plate, through the open ferrite and close the ferrite.
6. Pass the inline connector P/J 5 to the Touch Screen through the slot in the shield and reconnect it. (Do not run this cable through the ferrite.)
7. Replace LCD wires. Attach inverter shield with two screws.
8. Join cables previously disconnected.
9. Join the front and rear sections of the DCU enclosure together securing it with four screws.

   NOTE: Ensure no cables are pinched or twisted while performing this step.

DCU - ***Power Switch Light***

Power Switch Bulb Removal

1. Gently pry the lens from the Power Switch to the rear of the unit. Note the orientation of the locking tabs as the lens is removed.
2. Remove the bulb from the Power Switch socket.

Power Switch Bulb Replacement

1. Insert the replacement bulb in the Power Switch socket.
2. Replace the lens with locking tabs oriented as noted in removal.

DCU - ***Power Switch***

Power Switch Removal

1. The DCU enclosure consists of two sections. Remove four screws from the back plate of the DCU enclosure.
2. Separate the two halves.

   NOTE: Cables are connected between the two halves. Use caution when separating the sections.

3. Disconnect the P70 (power switch).
4. Push Power Switch through from inside.

Power Switch Replacement

1. Feed the Power Switch through hole from outside and push it in, until it locks in place.
2. Connect P70 (power switch).
3. Join the front and rear sections of the DCU enclosure together securing it with four screws.

   NOTE: Ensure no cables are pinched or twisted while performing this step.

DCU - ***LCD***

LCD Removal

1. The DCU top enclosure consists of two sections. Remove four screws from the back of the DCU enclosure.
2. Separate the two halves.

   NOTE: Cables are connected between the two halves. Use caution when separating the sections.

3. Disconnect P/J 22 (Inverter Power)
4. Remove two screws from the inverter shield can covering the inverter card. Remove the shield can.
5. Disconnect cables CN2 and CN3 from the inverter card.
6. Open the ferrite shield then disconnect the in-line connector P/J5 from the Touch Screen and pass it through the opening in the shield plate.
7. Remove four screws that secure the shield plate to the LCD. Remove the shield plate.

   NOTE: Wires are routed through the shield plate. Use caution when separating the shield plate from the LCD display.

8. Lift the LCD shield off.
9. Disconnect the cable attached to the LCD by lifting up on it.
10. Remove the LCD from the plastic isolation shield.

LCD Replacement

1. Place the LCD isolation shield over the LCD, then place the LCD on top of the Touch Screen with the connector on the same side as the Touch Screen connector, aligned with the edge of the bezel.
2. Route the LCD cable through the hole in the shield plate, through the open ferrite shield and connect to the LCD by pressing it together.
3. Place the shield plate over the LCD and secure it with four screws.

   NOTE: Ensure no cables are pinched or twisted while performing this step.

4. Connect CN2 and CN3 to the Inverter card.
5. Replace the inverter shield can covering the inverter card, securing it with two screws.
6. Pass the in-line Touch Screen connector P/J5 through the hole in the shield plate and connect it.
7. Connect P/J 22 (Inverter Power)
8. Join the front and rear sections of the DCU enclosure together, securing it with four screws.

   NOTE: Ensure no cables are pinched or twisted while performing this step.

DCU - ***DCU Interface Card***

Interface Card Removal

1. The DCU enclosure consists of two sections. Remove four screws from the back plate of the DCU enclosure.
2. Separate the two halves.

   NOTE: Cables are connected between the two halves. Use caution when separating the sections.

3. Disconnect P/J 22 (Inverter Power)
4. Disconnect P23 and P33.
5. Disconnect P/J 4 (cable) from the Single Board Computer (SBC).
6. Disconnect P/J 24 (Ethernet connector).
7. Disconnect P/J 20 (power switch) and P/J 28 (head cable).
8. Disconnect P/J 30 (speaker connector).
9. Disconnect P/J 25 and P/J 26 (grey ribbon cables).
10. Remove one screw securing shield or cable to interface card.
11. Remove one screw securing the PCMCIA bracket. Remove the bracket.
12. Remove four screws securing the SBC card to the interface card.
13. Remove the SBC card.
14. Remove five screws securing the interface card.
15. Lift up on the right side of the interface card (the side farthest away from the start switch connector) and slide the card out.

Interface Card Replacement

1. Carefully place the new interface card in position by angling the right side (side with Start Switch connector), in first. Secure with five screws.
2. Connect P/J 20 (power switch) and P/J 28 (head cable).
3. Secure shield ground with one screw.
4. Secure the SBC card to the interface card with four screws.
5. Secure the PCMCIA bracket with one screw.
6. Connect any hand switches (if originally connected).
7. Connect P/J 30 (speaker connector).
8. Connect P/J 24 (Ethernet connector).
9. Connect P/J 25 and P/J 26 (gray ribbon cables) going to the interface card.
10. Connect P23 and P33.
11. Connect P/J 22 (inverter power).
12. Join the front and rear sections of the DCU enclosure together, securing it with four screws.

    NOTE: Ensure no cables are pinched or twisted while performing this step.

DCU - ***Single Board Computer (SBC)***

SBC Removal

1. The DCU enclosure consists of two sections. Remove four screws from the back plate of the DCU enclosure.
2. Separate the two halves.

   NOTE: Cables are connected between the two halves. Use caution when separating the sections.

3. Disconnect P/J 2 and P/J 7 (gray ribbon cables).
4. Disconnect P/J 4 (cable) from the SBC.
5. Disconnect P/J 5 and P/J 16 from the SBC card.
6. Disconnect P/J 8 (Ethernet connector).
7. Remove one screw securing the PCMCIA bracket. Remove the bracket.
8. Slide the PCMCIA card out of its socket and set aside.
9. Remove four screws securing the SBC to the interface card.
10. Lift up and disconnect P/J 12 from the back of the SBC card.
11. Remove the SBC card.

SBC Replacement

1. Connect P/J 12 to the back of the SBC card.
2. Secure the SBC card to the interface card with four screws.
3. Connect P/J 8 (Ethernet cable).
4. Slide the PCMCIA card into its socket.
5. Secure the PCMCIA bracket with one screw. Ensure the ethernet cable is behind the bracket.
6. Connect P/J 5 and P/J 16 to the SBC card.
7. Connect P/J 4.
8. Connect P/J 2 and P/J 7 (gray ribbon cables).
9. Join the front and rear sections of the DCU enclosure together, securing it with four screws.

   NOTE: Ensure no cables are pinched or twisted while performing this step.

DCU - ***Inverter Card***

Inverter Card Removal

1. The DCU enclosure consists of two sections. Remove four screws from the back of the DCU enclosure.
2. Separate the two halves.

   NOTE: Cables are connected between the two halves. Use caution when separating the sections.

3. Remove two screws from the shield can covering the inverter card. Remove the shield can.
4. Disconnect three cables CN1, CN2, and CN3 from the inverter card.
5. Remove the inverter card by removing the two standoffs.

Inverter Card Replacement

1. Install the inverter card using the two standoffs.
2. Connect cables CN1, CN2, and CN3 to the inverter card.
3. Replace the shield can covering the inverter card, securing it with two screws.
4. Join the front and rear sections of the DCU enclosure together, securing it with four screws.

   NOTE: Ensure no cables are pinched or twisted while performing this step.

DCU - ***Fuses***

Fuses Removal

1. Disconnect the AC power cord from the DCU.
2. Gently pry the fuse holder from the fuse access panel located at the line power cord connector on the rear of the assembly.
3. Remove the fuse from the fuse holder.

Fuses Replacement

1. Replace the fuse in the fuse holder.
2. Replace the fuse holder into the fuse access panel.
3. Connect the AC power cord to the DCU.

DCU - ***Expansion Base Cable***

Expansion Base Cable Removal

1. Disconnect two FO cables plugged into the back of the DCU.
2. Turn the DCU assembly upside down and remove four screws that hold the bottom cover plate on.
3. Carefully lift the plate off the Bottom cover and disconnect the ground wire attached to the plate.
4. Disconnect P/J 108 from the Expansion Base Interface card by sliding the locking sleeve to unlock it.
5. Remove ferrite filter from Expansion Base cable.
6. Remove the blank off-plate from P109 (isi).
7. Disconnect P/J 107 and P/J 101 from the Expansion Base Interface card.
8. Remove four screws securing the Expansion Base Interface card.
9. Remove the Expansion Base Interface card.
10. Remove four screws holding the bottom cover to the top section and push the cable through.
11. The DCU enclosure consists of two sections. Remove four screws from the bottom cover of the DCU enclosure.
12. Separate the two halves - Bezel and Bottom cover.

    NOTE: Cables are connected between the two halves. Use caution when separating the sections

13. Disconnect P/J 22 (inverter power).
14. Disconnect P/J 20 (power switch) and P/J 28 (head cable).
15. Disconnect P/J 30 (speaker connector).
16. Disconnect any start or hand switches (if connected).
17. Remove screw securing cable to the DCU Interface card.
18. Remove four screws securing the DCU Interface card.
19. Lift up on the right side of the DCU Interface card (the side farthest away from the start switch connector) and slide the DCU Interface card out.
20. Remove the six screws securing the shield plate and Expansion Base cable into the top cover.
21. Remove the center hinge cover plate.
22. Remove the Expansion Base cable from the Bottom cover.

DCU - ***Expansion Base Cable (continued)***

Expansion Base Cable Replacement

1. Route the expansion base cable from the Expansion Base up through the top cover.
2. Replace the center hinge cover plate securing it with six screws.
3. Slide the interface card in from the right side (the side farthest away from the start switch connector) and gently push down into place.
4. Secure the interface card with four screws.
5. Secure cable to the interface card with one screw.
6. Connect any hand switches (if originally connected).
7. Connect P/J 20 (power switch) and P/J 28 (head cable).
8. Connect P/J 30 (speaker connector).
9. Connect P/J 22.
10. Join the front and rear sections of the DCU enclosure together, securing it with four screws.

    NOTE: Ensure no cables are pinched or twisted while performing this step.

11. Route the expansion base cable through the hole in the bottom cover.
12. Replace the bottom cover assembly securing it with four screws to the top section One screw also holds the cable clamp assembly.
13. Replace the expansion base interface card securing it with four-screws.
14. Connect P/J 107, P/J 101, and ground wire to the expansion base interface card.
15. Connect P/J 108 to the interface card by sliding the locking sleeve to the left.
16. Attach the ferrite filter to the expansion base cable with two cable-ties.
17. Connect the ground wire to the bottom cover plate.
18. Connect the bottom cover plate to the DCU assembly using four screws.
19. Connect two FO cables to the back of the DCU and blank off-plate to P109.

DCU - ***Expansion Base Interface Card***

Expansion Base Interface Card Removal

1. Disconnect two FO cables plugged into the back of the DCU.
2. Turn the DCU assembly upside down and remove four screws holding the bottom cover plate on.
3. Slowly lift the cover plate off the bottom cover and disconnect the ground wire attached to the cover plate.
4. Disconnect P/J 108 from the expansion base interface card by sliding the locking sleeve to the left.
5. Disconnect P/J 107 and P/J 101 from the expansion base interface card.
6. Remove four Ethernet cables from the expansion base interface card.
7. Disconnect P/J 106 (AC GND) from Expansion Base Interface Card.
8. Remove two screws from the 15 pin ‘D’ connector cover plate.
9. Remove four screws securing the expansion base interface card.
10. Remove the expansion base interface card.

Expansion Base Interface Card Replacement

1. Replace the expansion base interface card, securing it with four screws.
2. Connect four Ethernet cables to the expansion base interface card.
3. Connect P/J 107 and P/J 101 to the expansion base interface card.
4. Connect P/J 106 (AC GND) to Expansion Base Interface Card.
5. Replace the 15 pin ‘D’ connector cover plate, using the two screws.
6. Connect P/J 108 to the expansion base interface card by sliding the locking sleeve to the left.
7. Connect the ground wire to the cover plate.
8. Attach the cover plate to the bottom cover with four screws.
9. Connect two FO cables to the back of the DCU.

DCU ***- Power Supply***

Power Supply Removal

1. Turn the DCU assembly upside down and remove four screws holding the bottom cover plate on.
2. Slowly lift the cover plate off the bottom cover and disconnect the ground wire attached to the cover plate.
3. Disconnect P/J 1, P/J 2, and the ground wire from the power supply.
4. Remove four screws holding the power supply to the bottom cover.
5. Remove the power supply.

Power Supply Replacement

1. Replace the power supply securing it to the bottom cover with four screws.
2. Connect P/J 1, P/J 2, and the ground wire to the power supply.
3. Connect the ground wire to the cover plate.
4. Attach the cover plate to the bottom cover with four screws.

DCU - ***Hub***

Hub Removal

1. Turn the DCU assembly upside down and remove four screws holding the bottom cover plate on.
2. Slowly lift the cover plate off the bottom cover and disconnect the ground wire attached to the cover plate.
3. Disconnect four Ethernet cables from the hub.
4. Remove two screws from the hub bracket.
5. Disconnect the 5VDC connection from back of hub.
6. Remove the hub.

Hub Replacement

1. Connect the 5VDC connection from back of hub. Replace the hub in the hub bracket and secure the bracket with two screws.
2. Connect four Ethernet cables to the hub.
3. Connect the ground wire to the cover plate.
4. Attach the cover plate to the bottom cover with four screws.

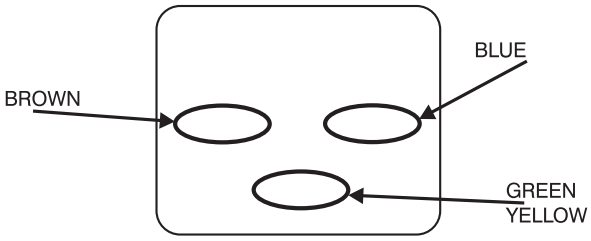
DCU *- Line Power Module*

Line Power Module Removal

1. Turn the DCU assembly upside down and remove four screws holding the bottom cover plate on.
2. Slowly lift the cover plate off the bottom cover and disconnect the ground wire attached to the cover plate.
3. Ensure AC power cord is disconnected from the DCU.
4. Disconnect all three wires from the back of the line power module.
5. Remove two screws holding the power line module to the bottom cover.
6. Slide the power line module out of the bottom cover.
7. Remove fuses if they are to be reused.

Line Power Module Replacement

1. Replace fuses.
2. Slide the power line module into the bottom cover.
3. Secure the power line module to the bottom cover with two screws.
4. Connect all three wires to the back of the line power module.
5. Connect the AC power cord to the DCU.
6. Reattach the ground wire to the cover plate.
7. Attach the cover plate to the bottom cover, securing it with four screws.



SCAN ROOM UNIT - ***Power Box***

Power Box Removal

1. Remove the battery pack (if installed).
2. Remove four screws from the Scan Room Unit base covers. The top two screws are covered with an access cover. Slide the cover up the pole to access the screws.
3. Remove the cover without the FO cable routed through it. Disconnect FO cables, disengage from the FO cleat, and remove the other cover.
4. Unscrew two flex shaft nuts, and disengage the flexshafts.
5. Loosen four wing nuts, (two top and two bottom) on the leveler screws.
6. Back the leveler screws away from the power box.
7. Lift the power box halfway out of the Scan Room Unit base. Disconnect P/J 206 (head cable), and remove the power box.

Power Box Replacement

1. Place the power box halfway into the Scan Room Unit base.
2. Connect P/J 206, and slide the power box into the Scan Room Unit base.
3. Tighten the leveler screws towards the power box.
4. Tighten four wing nuts (two top, two bottom), on the leveler screws.
5. Insert the flexshafts and tighten two flexshaft nuts.
6. Replace the Scan Room Unit base covers. Reconnect the FO connector and insert the FO cable in the cleat before replacing the cover.
7. Secure the Scan Room Unit base covers with four screws.
8. Slide the access cover over the top two screws.
9. Replace the battery pack (if originally installed).

SCAN ROOM UNIT - ***Covers***

Covers Removal

1. Remove the battery pack (if installed).
2. Remove four screws from the Scan Room Unit base covers. The top two screws are covered with an access cover. Slide the cover up the pole to access the screws.
3. Remove the cover without the FO cable routed through it. Disconnect FO cables, disengage from the cable cleat, and remove the other cover.

Covers Replacement

1. Replace the Scan Room Unit base covers. Reconnect the FO connector, and insert FO cable the cleat, before replacing the cover.
2. Secure the Scan Room Unit base covers with four screws.
3 Slide the access cover over the top two screws.
4 Replace the battery pack (if originally installed).

SCAN ROOM UNIT - ***Servo/CPU Card***

Servo/CPU Card Removal

1. Remove the battery pack (if installed).
2. Remove four screws from the Scan Room Unit base covers. The top two screws are covered with an access cover. Slide the cover up the pole to access the screws.
3. Remove the cover without the FO cable routed through it. Disconnect FO cables, disengage form the cable cleat, and remove the other cover.
4. Remove eight screws that fasten the front of the power box.
5. Use the card ejectors to remove the Servo/CPU card.

Servo/CPU Card Replacement

1. Insert the Servo/CPU card.
2. Secure the front of the Power Box with eight screws.
3. Replace the Scan Room Unit base covers. Reconnect the FO connector, and engage the FO cable in the cleat, before replacing the cover.
4. Secure the Scan Room Unit base covers with four screws.
5. Slide the access cover over the top two screws.
6. Replace the battery pack (if originally installed).

NOTE: Pot and Pressure calibration is required after the replacing the Servo/CPU card.

SCAN ROOM UNIT - ***Power Drive Card***

Note: Power Drive Cards for Spectris Solaris - 3004515 and Spectris Solaris EP - 3012064 **are not interchangeable**.

Power Drive Card Removal

1. Remove the battery pack (if installed).
2. Remove four screws from the Scan Room Unit base covers. The top two screws are covered with an access cover. Slide the cover up the pole to access the screws.
3. Remove the cover without the FO cable routed through it. Disconnect FO cables, disengage from the cable cleat, and remove the other cover.
4. Remove eight screws that fasten the front of the Power Box.
5 Disconnect P/J 221 and P/J 222 (motor power wires) from the Power Drive card
6. Using the card ejector, slide the Power Drive card out of the Power Box.

Power Drive Card Replacement

1. Slide the Power Drive card into the enclosure.
2. Connect P/J 221 and P/J 222 to the Power Drive card.
3. Secure the front of the Power Box with eight screws.
4. Replace the Scan Room Unit base covers. Reconnect the FO connector, and engage the DO cable cleat, before replacing the cover.
5. Secure the Scan Room Unit base covers with four screws.
6. Slide the access cover over the top two screws
7. Replace the battery pack (if originally installed).

SCAN ROOM UNIT - ***Stand Base Interface Card***

Note: Stand Base Cards for Spectris Solaris - 3004682 and Spectris Solaris EP - 3011942 **are not interchangeable**.

Interface Card Removal

1. Remove the battery pack (if installed).
2. Remove four screws from the Scan Room Unit Base covers. The top two screws are covered with an access cover. Slide the cover up the pole to access the screws.
3. Remove the cover without the FO cable routed through it. Disconnect FO cables, disengage from the cable cleat, and remove the other cover.
4. Remove the Power Box, Servo/CPU Card, and Power Card. (Reference previous procedures, if needed).
5. Remove eight screws holding the rear cover.
6. Lift the back plate off carefully since cables are still connected on the other side.
7. Disconnect P/J 201 (power); P/J 203 and 204 (motor encoder A & B).
8. Remove the four screws securing the Stand Base Interface card to the rear plate.
9. Remove the Stand Base Interface card.

Interface Card Replacement

1. Replace the Stand Base Interface card and secure it to the rear plate with four screws. Ensure the gaskets are on connector P/J 206 and P/J 207.
2. Connect P/J 201 (power); P/J 203 and 204 (motor encoder A & B).
3. Carefully replace the back plate onto the power box, securing it with eight screws.
4. Replace the Servo/CPU card.
5. Replace the power drive card.
6. Connect P/J 221 and P/J 222 to the power drive card.
7. Secure the front of the power box with eight screws.
8. Install Power Box into the Head Stand and secure.
9. Replace the Scan Room Unit Base covers. If the cover with the FO connector routed through it was removed, reconnect the FO connector first before replacing the cover.
10. Secure the Scan Room Unit Base covers with four screws.
11. Slide the access cover over the top two screws
12. Replace the battery pack (if originally installed).

SCAN ROOM UNIT - ***Motors***

Motors Removal

1. Remove the battery pack (if installed).
2. Remove four screws from the Scan Room Unit Base covers. The top two screws are covered with an access cover. Slide the cover up the pole to access the screws.
3. Remove the cover without the FO cable routed through it.
4. If desired, lay the injector head on the side with the front of the Power Box up.
5. Remove eight screws that fasten the front plate onto the Power Box.
6. Disconnect P/J 221 and P/J 222 (motor power wires) from the power drive card.
7. Use the card ejectors to slide the Power Drive card out of the enclosure.
8. Use the card ejectors to remove the Servo/CPU card.
9. Disconnect the flexshaft of the motor to be replaced.
10. Disconnect the encoder wires off the Stand Base interface card for the motor to be replaced (A motor - P/J 203 or B motor - P/J 204).

    Note: Note orientation of the motor in the Power Box prior to removal.

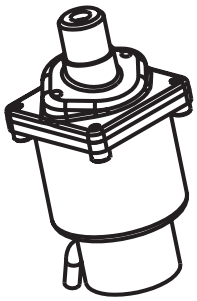
11. Remove two screws securing the motor to the enclosure. Hold the motor to prevent it from falling while the last screw is being removed.
12. Remove the motor from the Power Box.
13. Remove four screws holding the mounting plate to the motor and slide the plate off.
14. Slide the black coupling off the motor shaft.

SCAN ROOM UNIT - ***Motors (continued)***

Motors Replacement

1. Slide the black coupler onto the motor shaft.
2. Connect the mounting plate to the motor with four screws.

   NOTE: Mount the motor such that the shaft is angled towards the center of the Power Box.



3. Secure the motor to the housing with two screws.
4. Connect encoder wires (P/J 203 or P/J 204) to the interface card.
5. Slide the Servo/CPU card into place.
6. Slide the Power Drive Card into place.
7. Connect P/J 221 and P/J 222 (motor power wires) to the Power Drive card.
8. Fasten the front of the Power Box with eight screws.
9. Stand the unit upright and replace the Scan Room Unit base covers.
10. Secure the Scan Room Unit Base covers with four screws.
11. Slide the access cover over the top two screws.
12. Replace the battery pack (if originally installed).

NOTE: The mounting plate should be aligned as shown above. High side of the mounting plate with the wire harness of the motor.

SCAN ROOM UNIT - ***Wheels***

Wheels Removal

1 Tip the Scan Room Unit on its side.

2. Slide the wheels straight out, using some force to overcome the friction ring

Wheels Replacement

1. Slide the wheels straight in, using some force to overcome the friction ring.
2. Set the Scan Room Unit to its upright position.

SCAN ROOM UNIT - ***Sensor Card***

Sensor Card Removal

1. Remove five screws securing the top head cover to the underside of the injector head assembly.
2. Slowly lift the top head cover off. Some resistance from the connector will be felt.
3. Disconnect P/J 324 and P/J 325 (pressure transducer cable connectors).
4. Disconnect P/J 327 and P/J 328 from size sensors
5. Remove two screws holding the Sensor Card to the bottom cover.
6. Lift up on the Sensor Card.
7. Disconnect P/J 323 (head cable), P/J 321, and P/J 322 (pot connectors) from the bottom of the Sensor Card.
8. Remove the Sensor Card.

Sensor Card Replacement

1. Connect P/J 323, P/J 321, and P/J 322 to the bottom of the Sensor Card.
2. Secure the Sensor Card to the bottom head cover with two screws.
3. Connect P/J 327 and P/J 328 to size sensors.
4. Connect P/J 324 and P/J 325. Ensure that the cables are routed between the Flex Shaft casings and do not interfere with the Piston Rods.
5. Replace the top head cover securing it to the underside of the injector head assembly, with five screws.

SCAN ROOM UNIT - ***Head Switch Card***

Head Switch Card Removal

1 Remove five screws securing the top head cover to the underside of the injector head assembly.

2. Slowly lift the top head cover off. Some resistance from the connector will be felt.

3 Disconnect P/J 301 and P/J 302 (arm light connectors)

4 Remove five screws holding the head switch card to the top head cover.

5 Lift the head switch card out.

Head Switch Card Replacement

1. Replace the head switch card, securing it to the top head cover with five screws.

2. Ensure that all switch boots are in place.

3. Connect P/J 301 and P/J 302.

4. Replace the top head cover, securing it to the underside of the injector head assembly with five screws.

SCAN ROOM UNIT - ***Head Cable***

Head Cable Removal

1. Remove the battery pack if installed.
2. Remove four screws from the Scan Room Unit base covers. The top two screws are covered with an access cover. Slide the cover up the pole to access the screws.
3. Remove the cover without the FO cable routed through it. Disconnect FO cables, disengage from the FO cleat, and remove the other cover.
4. Disconnect P/J 206 (head cable) and flex shafts from power box.
5. Remove ferrite clamp from the cable and save.
6. Remove the Power Box from the Scan Room Unit base.
7. Remove five screws securing the top head cover. Slowly remove the top head cover. Some resistance from the connector will be felt.
8. Disconnect all connections to the sensor card.
9. Remove two screws securing the sensor card. Remove sensor card.
10. Disconnect the flex shafts by first removing the U-shaped retainers, then removing the flex shafts from the rear plate.
11. Remove the Mechanical Drive assembly from the bottom head cover. Be careful not to damage the pressure transducer cables attached to the Mechanical Drive assembly.

EP Systems: Remove screws that hold head cable shield clamp to bottom cover. Remove clamp from cover.

12. Remove the four screws securing the bottom head cover and remove.
13. Remove ferrite clamp from the cable and save.
14. Fold the head cable connector over and tightly wrap the connector to the cable with tape. This makes it easier to feed the connector through the Scan Room Unit tube.

    NOTE: Removing the bottom head cover may make it easier to pull the cable through the Scan Room Unit tube.

15. Tie a string around the cable and push it into the Scan Room Unit tube.
16. Separate the upper tube from the lower stand tube by pulling apart (this will later aid in feeding the cables).
17. Pull the cable out from the bottom of the Scan Room Unit tube, leaving the string routed through the tube.

SCAN ROOM UNIT - ***Head Cable (continued)***

Head Cable Replacement

1. Fold the head cable connector over and tightly wrap the connector to the cable with tape. This makes it easier to feed the connector through the Scan Room Unit tube. Tie the string to the cable and pull the cable up through the upper and lower stand tubes.
2. Install the upper tube onto the lower stand tube.
3. Install ferrite clamp, previously removed, on the cable 4-1/2' (10.5 cm), from end of cable and secure with cable tie.
4. Install the bottom head cover. Install the Mechanical Drive assembly into the bottom head cover.

EP Systems: Secure the clamp to the head cable covering the shield. Attach the clamp to the bottom head cover with the screws.

5. Replace the flex shafts into the rear plate, connecting them with the U-shaped retainers.
6. Install the sensor card with the two screws previously removed. Reconnect all previously removed connections.
7. Install top head cover with the five screws previously removed.
8. Install the flex shafts, FO cables and head cable into the power box. Install the power box into the Scan Room Unit base and secure.
9. Install ferrite clamp, previously removed, on the cable by head cable connector J206 and secure with cable tie.
10. Secure the Scan Room Unit base covers with four screws previously removed. Slide the access cover down over the upper screws.
11. Replace the battery pack (if originally installed).

NOTE: Pot alignment is required after the mechanical drive has been removed and reinstalled.

SCAN ROOM UNIT - ***Flex Shafts***

Flex Shafts Removal

1. Remove the battery pack (if installed).
2. Remove four screws from the Scan Room Unit base covers. The top two screws are covered with an access cover. Slide the cover up the pole to access the screws.
3. Remove the cover without the FO cable routed through it. Disconnect FO cables, disengage from the FO cleat, and remove the other cover.
4. Unscrew the flex shaft nut off the flex shaft to be replaced and disengage the shaft from the motor.
5. Slide the flex shaft to be replaced from its casing.

Flex Shafts Replacement

1. Replace the flex shaft in its casing.
2. Insert the flex shaft into the motor and screw the flex shaft nut onto the motor mount.
3. Replace the Scan Room Unit base covers. Reconnect the FO connector first before replacing the cover.
4. Secure the Scan Room Unit base covers with four screws.
5. Slide the access cover over the top two screws.
6. Replace the battery pack (if originally installed).

SCAN ROOM UNIT - ***Flex Shafts Casings***

Flex Shafts Casings Removal

1. Remove the battery pack (if installed).
2 Remove four screws from the stand base covers.
3. The cover with the FO cable routed through it can be pulled away; however, the FO connectors must be disconnected before the cover can be completely removed from the stand.
4. Disconnect P/J 206 (head cable) and flexshafts from motor box.
5. Remove the Power Box from the Scan Room Unit base.
6. Slide the flexshaft from the casing to be replaced.
7. Remove five screws securing the top head cover. Remove the top cover. Some resistance from the connector will be felt.
8. Disconnect all connections to the sensor card.
9. Remove two screws securing the sensor card. Remove sensor card.
10. Disconnect the flex shaft casings by first removing the U-shaped retainers, then removing the flexshaft casings from the rear plate.
11. Remove the mechanical assembly from the bottom head cover.

    NOTE: Removing the bottom head cover may make it easier to pull the cable through the Scan Room Unit tube.

12. Tie a string around the casing and push it into the Scan Room Unit.
13. Separate the upper tube from the lower Scan Room Unit tube by pulling apart (this will later aid in feeding the casing).
14. Pull casing out through the bottom of the Scan Room Unit tube, leaving the string routed through the stand tubes.

SCAN ROOM UNIT - ***Flex Shafts Casings (continued)***

Flex Shafts Casings Replacement

1. Attach string to the new casing on the end that does not have the plastic nut. Feed and pull the new casing back up through the Scan Room Unit tube.
2. Insert the upper tube onto the lower stand tube.
3. If previously removed, install the bottom head cover.
4. Install the mechanical assembly onto the bottom head cover.
5. Install the flexshaft casings into the rear plate, securing them with the U-shaped retainers.
6. Install the sensor card using the two screws previously removed. Restore all sensor card connections
7. Install the top head cover using the five screws previously removed.
8. Install the power box into the Scan Room Unit base, with connectors, and secure.
9. Slide the flexshaft into its casing. Screw the flexshaft nut onto the power box.
10. Secure the Scan Room Unit base covers with four screws previously removed. Slide the access cover down over the upper screws.
11. Replace the battery pack (if originally installed).

SCAN ROOM UNIT - ***Arm Lights***

Arm Lights Removal

1. Remove five screws securing the top head cover to the bottom head cover.
2. Slowly remove the top head cover. There will be some resistance from the connector.
3. Remove the defective bulb with a bulb extractor.

Arm Lights Replacement

1 Replace the defective bulb.

2. Replace the top head cover.
3. Secure the top head cover to the bottom head cover with five screws.

SCAN ROOM UNIT - ***Motor Knobs***

Motor Knobs Removal

1 Remove five screws securing the top head cover to the bottom head cover.

2. Release the motor knob clip by compressing toward the rear while sliding the knob from the shaft.

Motor Knobs Replacement

1 Compress the motor knob clip and at the same time slide the motor knob onto the shaft

2. Replace the top head cover.

3. Secure the top head cover to the bottom head cover with five screws.

SCAN ROOM UNIT - ***Mechanical Assembly***

Mechanical Assembly Removal

NOTE: Pressure and potentiometer alignment/calibration is required if the mechanical assembly is removed.

1. Remove five screws securing the top head cover to the bottom head cover.
2. Slowly remove the top head cover. There will be some resistance from the connector.
3. Disconnect the flex shaft casings by removing the U-shaped retainer, then remove the flex shaft casings from the rear plate.
4. Disconnect P/J 324 and P/J 325 (pressure transducer cable connectors). Free the cables from the cable clamps, if applicable.
5. Disconnect P/J 327 and P/J 328 from the sensor card.
6. Lift the entire mechanical assembly up.
7. Release the motor knob clip by compressing toward the rear while sliding the knob from the shaft along with the lens.
8. Slide the Syringe Interface assembly from the plunger shafts.

Mechanical Assembly Replacement

1. Slide the Syringe Interface assemblies onto the plunger shafts.
2. Install the entire mechanical assembly. Ensure the Syringe Interface assembly notch and plunger rotation stops are properly positioned in the bottom head cover.
3. Connect P/J 324 and 325 (pressure transducer) and P/J 327 and 328 (size sensor) to the sensor card.

   NOTE: Rotate the Syringe Interface assembly until the keys align properly with the grooves in the bottom head cover.

   NOTE: Ensure that the anti-rotation plates on the ballscrew assembly are properly positioned over the guides molded into the bottom head cover, and the potentiometer gears are fully engaged.

4. Insert the flex shafts into the rear plate, then connect with the U-shaped retainers.
5. Slide the lenses onto the ball screw shaft and insert them into the grooves in the bottom head cover.
6. Compress the motor knob clip and slide the it onto the shaft
7. Install the top head cover and secure it to the bottom head cover with five screws.

   NOTE: Pressure and potentiometer alignment/calibration is required after the mechanical assembly is replaced.

SCAN ROOM UNIT - *Syringe Interface / Size Sensing Assembly*

Syringe Interface/ Size Sensing Removal

1. Remove five screws securing the top head cover to the bottom head cover.
2. Slowly remove the top head cover. There will be some resistance from the connector.
3. Disconnect P/J 327 (A side) or P/J 328 (B side) (size sensing cable)
4. Lift up on the mechanical assembly and slide the Syringe Interface assembly from the plunger shaft on the side needing replaced.

Syringe Interface/ Size Sensing Replacement

1. Slide the Syringe Interface assembly onto the plunger shaft, then reseat the entire mechanical assembly into the bottom cover.

   NOTE: Rotate the Syringe Interface assembly until the keys align properly with the grooves in the bottom head cover.

   NOTE: Ensure that the anti-rotation plates on the ballscrew assembly are properly positioned over the guides molded into the bottom head cover, and the potentiometer gears are fully engaged

2. Connect P/J 327 or P/J 328 (size sensing cable).
3. Install the top head cover.
4. Secure the top head cover to the bottom head cover with five screws.

   NOTE: Potentiometer realignment is required if the mechanical assembly was disengaged from the potentiometer gears.

SCAN ROOM UNIT - ***Potentiometers***

Potentiometers Removal

1. Remove five screws securing the top head cover to the bottom head cover.
2. Slowly remove the top head cover. There will be some resistance from the connector.
3. Disconnect the flex shaft casings by removing the U-shaped retainers, then remove the flex shaft casings from the rear plate.
4. Disconnect P/J 324 and P/J 325 (pressure transducer cable connectors) from the sensor card.
5. Disconnect P/J 327 and P/J 328 from sensor card (syringe size detectors).
6. Remove two screws holding the Sensor Card to the bottom head cover.
7. Lift up on the Sensor Card.
8. Disconnect P/J 323 (head cable), P/J 321, and P/J 322 (pot connectors) from the bottom of the Sensor Card.
9. Remove the sensor card.
10. Carefully lift the mechanical assembly out of the cover and disconnect wires from the cable clamps when accessible.
11. Remove the pot wires from the cable clamps.
12. Remove the pot bracket from the bottom head cover.
13. Rotate the defective pot up and out of bracket.
14. Remove the snap ring from the pot shaft and slide pot gear off.

SCAN ROOM UNIT - ***Potentiometers (continued)***

Potentiometers Replacement

1. Slide the pot gear onto the pot shaft and secure with the snap ring.
2. Rotate replacement pot into bracket. Ensure that the pin on the bracket engages the slot on the potentiometer.
3. Insert the pot bracket into the bottom head cover.
4. Rotate the motor knobs, until the plungers are fully reversed.
5. Rotate potentiometer fully counter-clockwise, then rotate thirteen teeth clockwise before engaging drive assembly.
6. Install the entire mechanical assembly with the piston fully retracted.

   NOTE: Rotate the Syringe Interface assembly until the keys align properly with the grooves in the bottom head cover.

   NOTE: Ensure that the anti-rotation plates on the ballscrew assembly are properly positioned over the guides molded into the bottom head cover, and the potentiometer gears are fully engaged

7. Insert the flex shafts into the rear plate, then connect the flex shafts with the U-shaped retainers.
8. Ensure lenses are seated correctly.
9. Connect P/J 323, P/J 321, and P/J 322 to the bottom of the sensor card.
10. Secure the Sensor Card to the bottom head cover with two screws.
11. Connect P/J 327 and P/J 328 to sensor card (syringe size detectors).
12. Connect P/J 324 and P/J 325. Ensure that the cables are routed between the Flex Shaft casings and do not interfere with the Piston Rods.
13. Install the top head cover and secure it to the bottom head cover with five screws.

    NOTE: Pot calibration is required after the potentiometer is replaced.

SCAN ROOM UNIT - ***Load and Check for Air Switch Boots***

Load/Check for Air Switch Boot Removal

1. Remove five screws securing the top head cover to the bottom head cover.
2. Slowly remove the top head cover. There will be some resistance from the connector.
3. Remove five screws holding switch card to the top head cover.
4. Lift the switch card.
5. Remove the switch boot.

Load/Check for Air Switch Boot Replacement

1. Install the switch boot.
2. Install the switch card with the five screws previously removed.
3. Install the top head cover.
4. Secure the top head cover to the bottom head cover with five screws.

SCAN ROOM UNIT - ***Top Head Cover***

Top Head Cover Removal

1. Remove five screws securing the top head cover to the bottom head cover.
2. Remove the top head cover. There will be some resistance from the connector.
3. Disconnect P/J 301 and P/J 302 (arm light connectors).
4. Remove five screws holding switch card to the top head cover.
5. Lift the switch card.
6. Remove the Loading and Check for Air switch boots.
7. Remove the arm light harnesses for A and B.
8. New wire retainers (p/n 715-0301-500) for the top head cover are required.

Top Head Cover Replacement

1. Install new wire retainers for the head cover.
2. Secure the arm light harnesses for A and B.
3. Install the Load and Check for Air switch boots removed previously.
4. Install the switch card removed previously. Secure the switch card to the top head cover with five screws.
5. Connect P/J 301 and P/J 302.
6. Install the top head cover.
7. Secure the top head cover to the bottom head cover with five screws.

SCAN ROOM UNIT - ***Bottom Head Cover***

Bottom Head Cover Removal

1. Remove five screws securing the top head cover to the bottom head cover.
2. Slowly remove the top head cover. There will be some resistance from the connector.
3. Disconnect the flex shaft casings by removing the U-shaped retainers, then remove the flex shaft casings from the rear plate.
4. Disconnect P/J 323 (head cable) P/J 324 and P/J 325 (pressure transducer cable connectors) from the sensor card.
5. Remove the two screws securing the sensor card, and lift up.
6. Disconnect P/J 327 and P/J 328 (size sensor) from sensor card.
7. Disconnect P/J 321 and P/J 322 (potentiometer cable connectors) from sensor card.
8. Remove the sensor card.
9. Carefully lift the mechanical assembly out of the bottom head cover.
10. Remove the pot wires from the cable clamps.
11. Remove the pot bracket from the bottom head cover.
12. Remove four screws securing the bottom head cover to the stand.

EP Systems: Remove the screws that hold the head cable shield clamp to the bottom cover. Remove the clamp from the cable.

13. Lift bottom head cover off stand.
14. Remove inserts from bottom head cover. These inserts will be installed into the new bottom head cover.
15. Remove S/N tag from bottom head cover. This tag will be installed in the new bottom head cover.
16. New wire retainers (p/n 715-0301-500) for the bottom head cover are required.

SCAN ROOM UNIT - ***Bottom Head Cover (continued)***

Bottom Head Cover Replacement

1. Install new wire retainers on the new bottom head cover.
2. Install serial tag to bottom head cover.
3. Install inserts into new bottom head cover.
4. Install new bottom head cover onto the upper stand tube using four screws removed previously.

EP Systems: Secure the clamp to the head cable covering the shield. Attach the clamp to the bottom head cover with the screws.

5. Secure head cable to post on the bottom cover.
6. Insert the pot bracket into the bottom head cover. Secure pot wires to bottom head cover with wire retainers.
7. Install the entire mechanical assembly.
8. Insert the flex shafts into the rear plate, then connect the flex shafts with the U-shaped retainers.
9. Connect P/J 323, P/J 321, and P/J 322 to the bottom of the sensor card.
10. Secure the sensor card to the bottom head cover with two screws.
11. Connect P/J 327 and P/J 328 to sensor card.
12. Connect P/J 324 and P/J 325. Ensure that the cables are routed between the Flex Shaft casings and do not interfere with the Piston Rods.
13. Ensure the lenses are seated properly.
14. Install the top head cover.
15. Secure the top head cover to the bottom head cover with five screws.

NOTE: Pot alignment is required after the mechanical drive has been removed and reinstalled.

SCAN ROOM UNIT - ***Potentiometer Alignment***

1. With the top head cover off, lift the motor knobs up until the potentiometer gears disengage from the drive gears.
2. Rotate the motor knobs until fully reversed.
3. Rotate the potentiometer gear fully counter-clockwise, then rotate thirteen teeth clockwise.
4. Without disturbing either potentiometer or drive gear, engage the potentiometer gear into the drive gear.

5 Theory of Operation

The Spectris Solaris system consists of 3 basic parts:

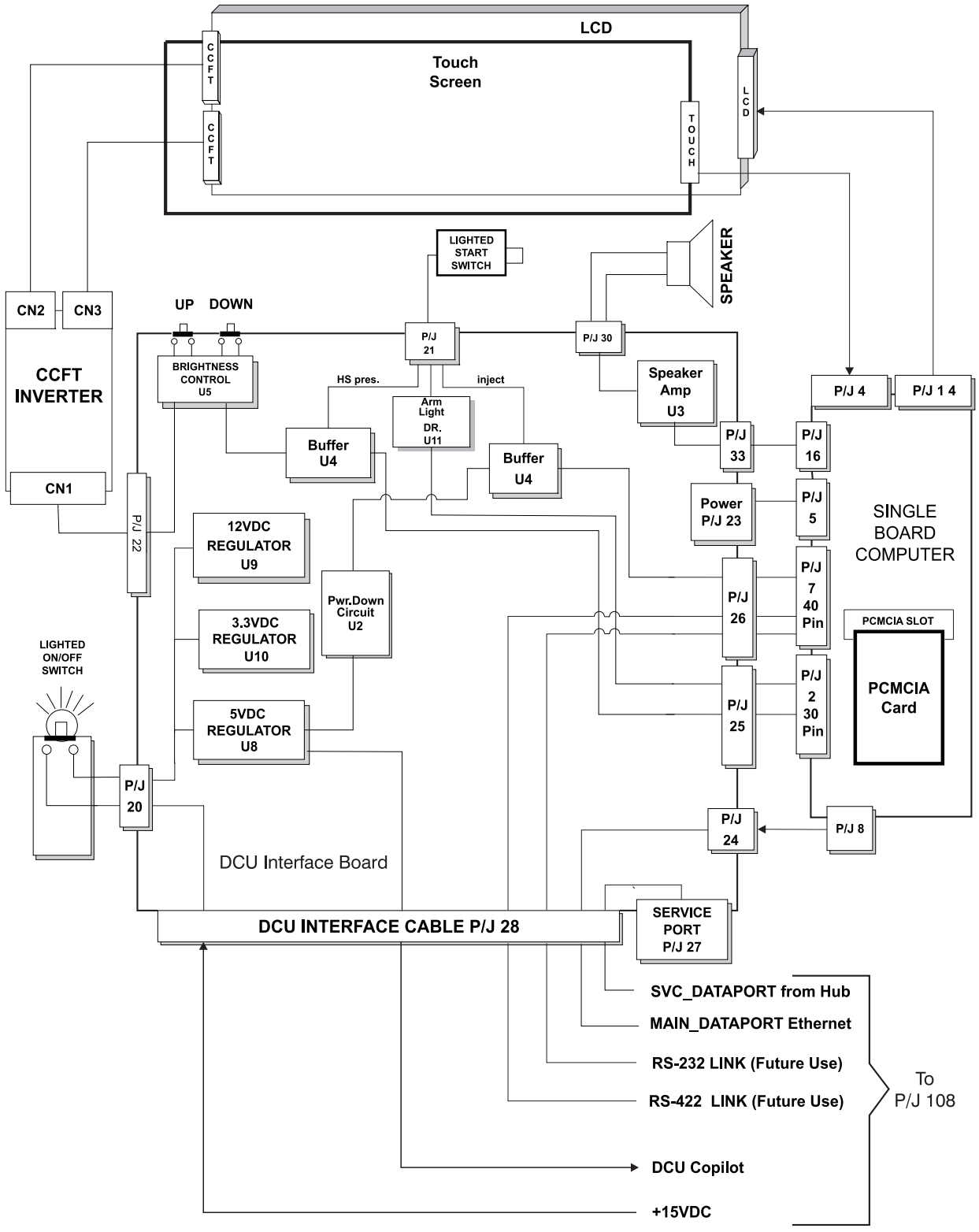
- Control Room Unit
- Head Stand Unit
- Battery Charger

The Control Room Unit and the Head Stand Unit are interconnected with a Fiber Optic communication cable.

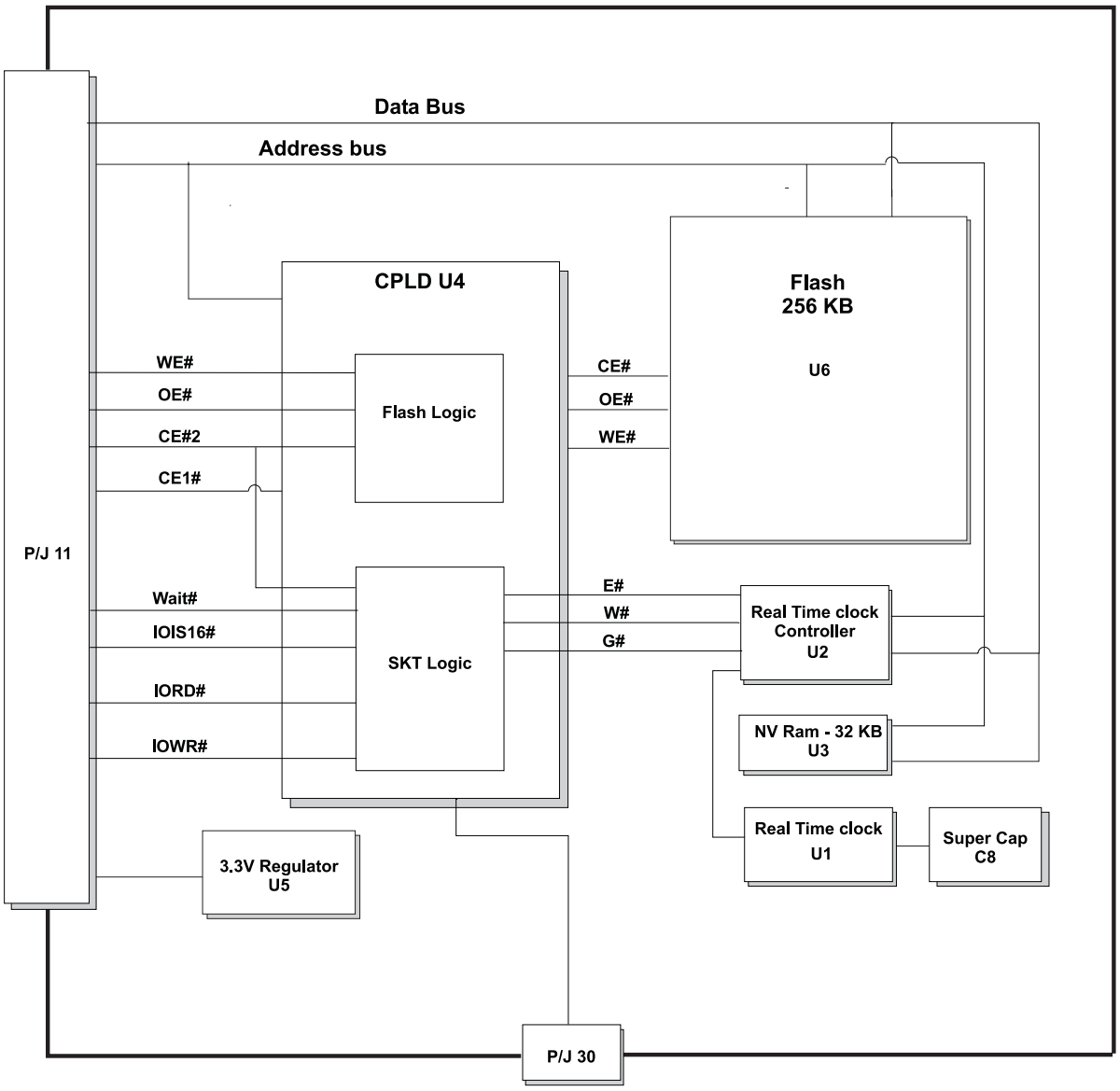
In this section, basic circuit block descriptions of each of the sub-systems are explained. A block diagram of each primary component is followed by a functional block description for each of the sub-systems.

Note: The battery charger has no serviceable parts.

DCU TOP BLOCK DIAGRAM



PCMCIA CARD


Data Bus
Address bus
CPLD U4
Flash
256 KB
U6
WE#
OE#
CE#2
CE1#
Flash Logic
CE#
OE#
WE#
P/J 11
Wait#
IOIS16#
IORD#
IOWR#
SKT Logic
E#
W#
G#
Real Time clock
Controller
U2
NV Ram - 32 KB
U3
Real Time clock
U1
Super Cap
C8
3.3V Regulator
U5
P/J 30

DCU top section

The DCU interface board is the primary PCB in the DCU enclosure. Support circuits are placed on this PCB including the physical support for the SBC. All connectors and switches, such as the start switch and interface cable from the Expansion Base are terminated at the DCU interface Card.

DCU top section - Block Diagram Description

Brightness Control
Two buttons. One button sends a voltage to the up count of an up-down counter, increasing the count to increase the amount of voltage sent to the Inverter Card; the other button causes the counter to count down, decreasing the voltage sent to the Inverter Card. This Inverter Card output is also sent to the SBC Card for monitoring.

CCFT Inverter
The brightness on the LCD is developed by the use of two CCFT (Cold Cathode Filament Tube). The CCFT inverter supplies a regulated, adjustable AC potential across the CCFT to start and maintain fluorescence. The brightness control input of 0-3 VDC is inversely proportional to the intensity of light emitted by the CCFT.

+12VDC Regulator
The +15 VDC power supply feeds power to a switching regulator providing a +12 VDC power level to the CCFT inverter board required to light the CCFT on the LCD panel and supplies power to the audio amplifier.

+5VDC Regulator
The +15 VDC power supply feeds power to a switching regulator providing a +5 VDC power level to most logic circuits.

+3.3VDC Regulator
The +15 VDC power supply feeds power to a switching regulator providing a +3.3 VDC power level to most logic circuits.

Single Board Computer (SBC)
The SBC is the master controller for system functions and system communications. It is comprised of the following:

32 - bit StrongARM SA-1110 RISC processor, 200 MHz
UCB 1200 Codec
28 Kbytes of EPROM (boot device)
4/12 Analog inputs
16 MB 100MHz SDRAM
3 UARTS
16 MBytes Flash
IRDA/RS485
Ethernet interface: 10Base T
AVR Microcontroller with "Smart I/O" support
PCMCIA Interface
Power Management
LCD Panel Interface

Speaker Amplifier
The amplifier is driven by an audio signal provided by the SBC Card the signal is amplified and sent to the speaker located on the rear cover. Volume and pitch are controlled by the SBC Card.

PCMCIA Card
This card contains the Real Time Clock for the system, 32 Kbytes of Non-Volatile (NV) ram and 256 Kbytes of Boot Flash.

Start Switch
The start switch signals are buffered by the DCU Interface Card and sent to the SBC Card. The signals are fed through a set of normally open and normally closed contacts along with Start Switch Present line.

Arm light drive for Start Switch
The start switch contains an LED driven from a drive circuit on the DCU Interface Card from the SBC.

Touch Screen
The touch screen is an analog output device that is run directly from the SBC Card.

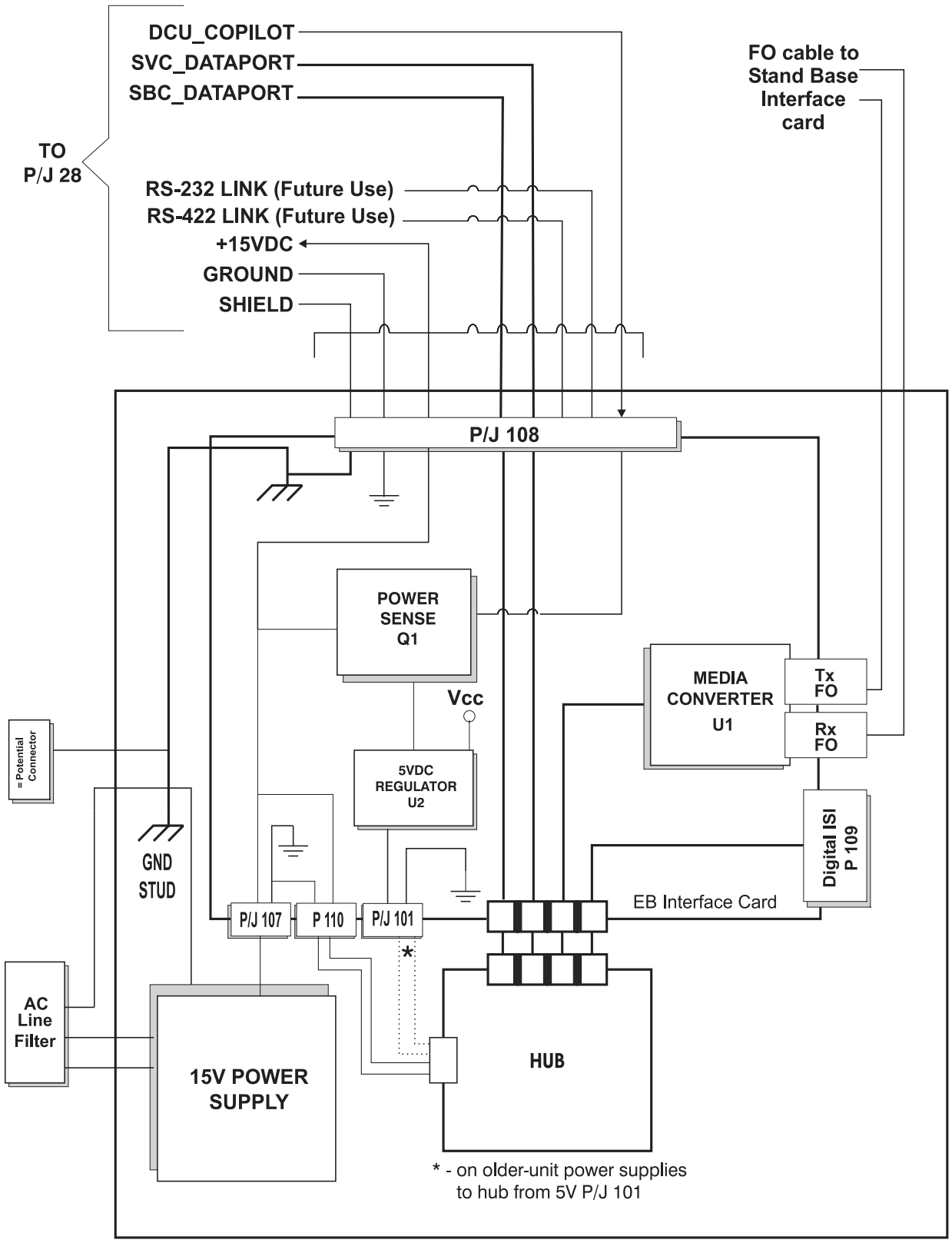
LCD
The primary visual interface to the operator is a 640 x 480 Color Liquid Crystal Display (LCD) panel with a physical dimension of 10.4” diagonally. This is driven directly from the SBC Card.

On/Off Switch
The on/off switch provides the means to power down the system. The +15 VDC main power is switched through a single pole, single throw lighted switch. The light is run off +5VDC

DCU Copilot
This signal enables and disables the +5VDC regulator on the Expansion Base Interface Card.

Power Down Indicator
This circuit provides an early warning to the processor when the +15VDC supply rail decays to +12VDC.

DCU EXPANSION BASE



DCU Expansion Base - Block Diagram Description

Ethernet HUB.

Ethernet Hub

The Ethernet hub is the connection point for all Ethernet communications. The network is arranged in a star topology with each segment (SBC, FO communications, Service Port, and an external interface) connecting to a port on the hub. Packets received on one port are copied to all other ports, allowing all ports on the network to see all packets. The hub is powered by 15 volts (5 volts on older units), from the Expansion Base Interface Cards.

Media Converter

The Media Converter circuit converts standard 10Base-T Ethernet over Copper to 10Base-FL Ethernet over fiber and vice-versa for transmission to the head stand.

Power Sense

The Power sense circuit watches a dedicated digital line (DCU Co pilot) between the DCU and EB for an indication that the control room unit has been turned on. The circuit then energizes the 5 VDC power to the EB circuitry and HUB on older units.

Three Phase Motor Function Operation

The Power Drive Card is a dual axis power amplifier that is designed to drive two brushless DC motors. Each power amplifier incorporates a three phase full-wave bridge design. The amplifiers are controlled by two sets of six pulse width modulated digital signals that are generated on the Servo/CPU Card. These signals are isolated and amplified so as to produce the voltages and currents necessary to drive the final power FETs in each of the bridges.

To understand how the Power Drive Card works, one must have a good understanding of how the entire servo system works, which includes the Servo/CPU Card, the Stand Base Interface Card and both BLDC (Stepper) motors. One must also understand BLDC motor principles and commutation techniques. This is a basic explanation on how motor stator excitation is performed, so as to produce rotary motion.

Table 1:

COMMUTATION TABLE CW ROTATION		
POWER AMPLIFIER OUTPUT		
ØA	ØB	ØC
L	H	X
L	X	H
X	L	H
H	L	X
H	X	L
X	H	L

LEGEND:
L - Low Side H - High Side X - OFF

The commutation table shown above shows the switching order that the power amplifier FETs must follow in order to cause clockwise motor shaft movement. The first 60° of rotation is accomplished by setting ABH and AAL high while holding all other signal low. Current is sourced from Phase B of the bridge, and sunk through Phase A as shown in Figure 1.

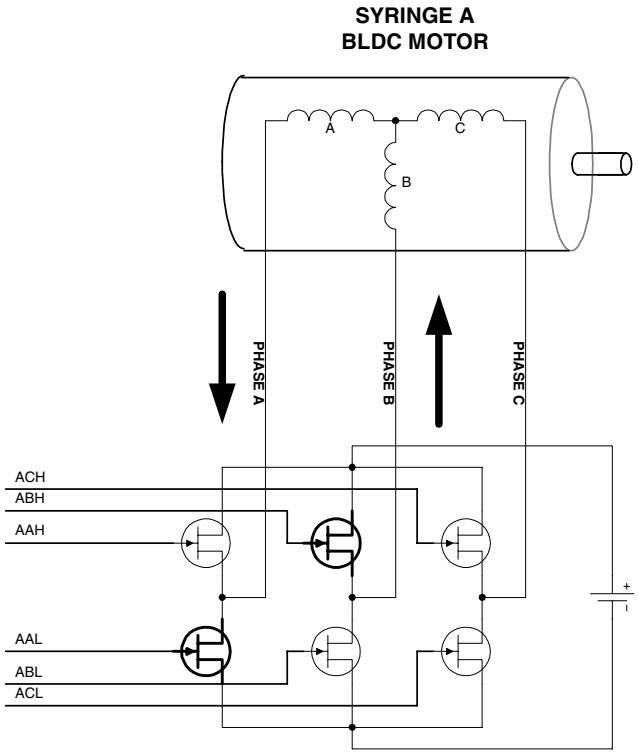


FIGURE 1

The next 60° of rotation are caused when ABH is shut off, AAL is left on, and ACH is switched on. Current sinking will still occur through the Phase A motor winding, however, current will now be sourced through Phase C as shown in Figure 2.

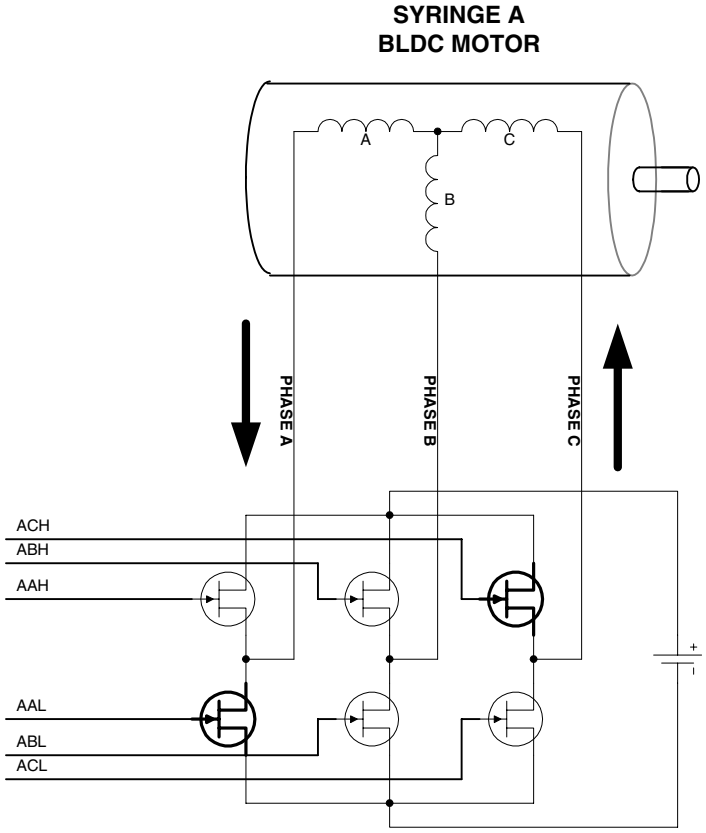


FIGURE 2

Once complete, then AAL is switched to the off state, and ABL is switched on, while ACH is kept on. The current sinking path is now transferred to Phase B. By following the commutation table, one can see that for a 360° cycle, each switching device is held on for 120° thus allowing current to flow through that particular phase for 120°. Figure 3 is a graphical display of the current flow through the motor windings for the given example.

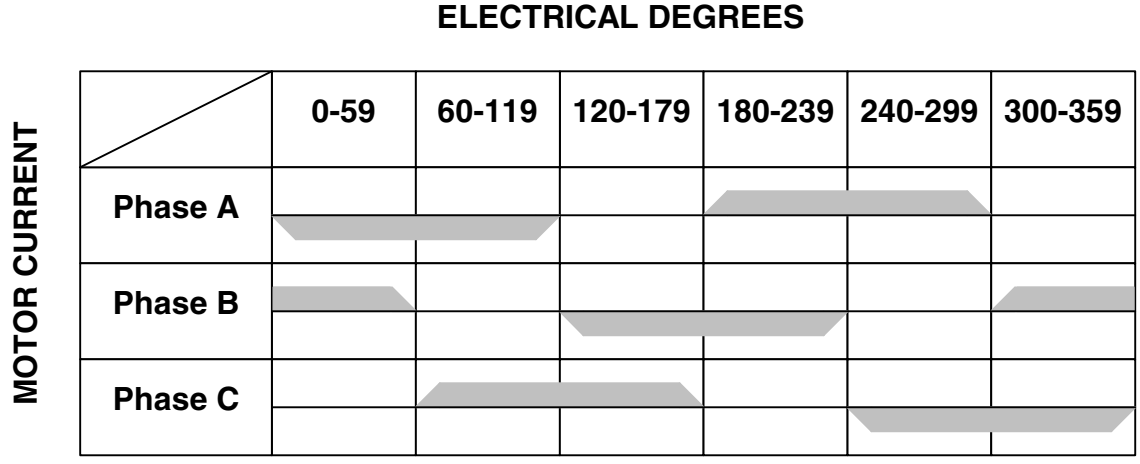
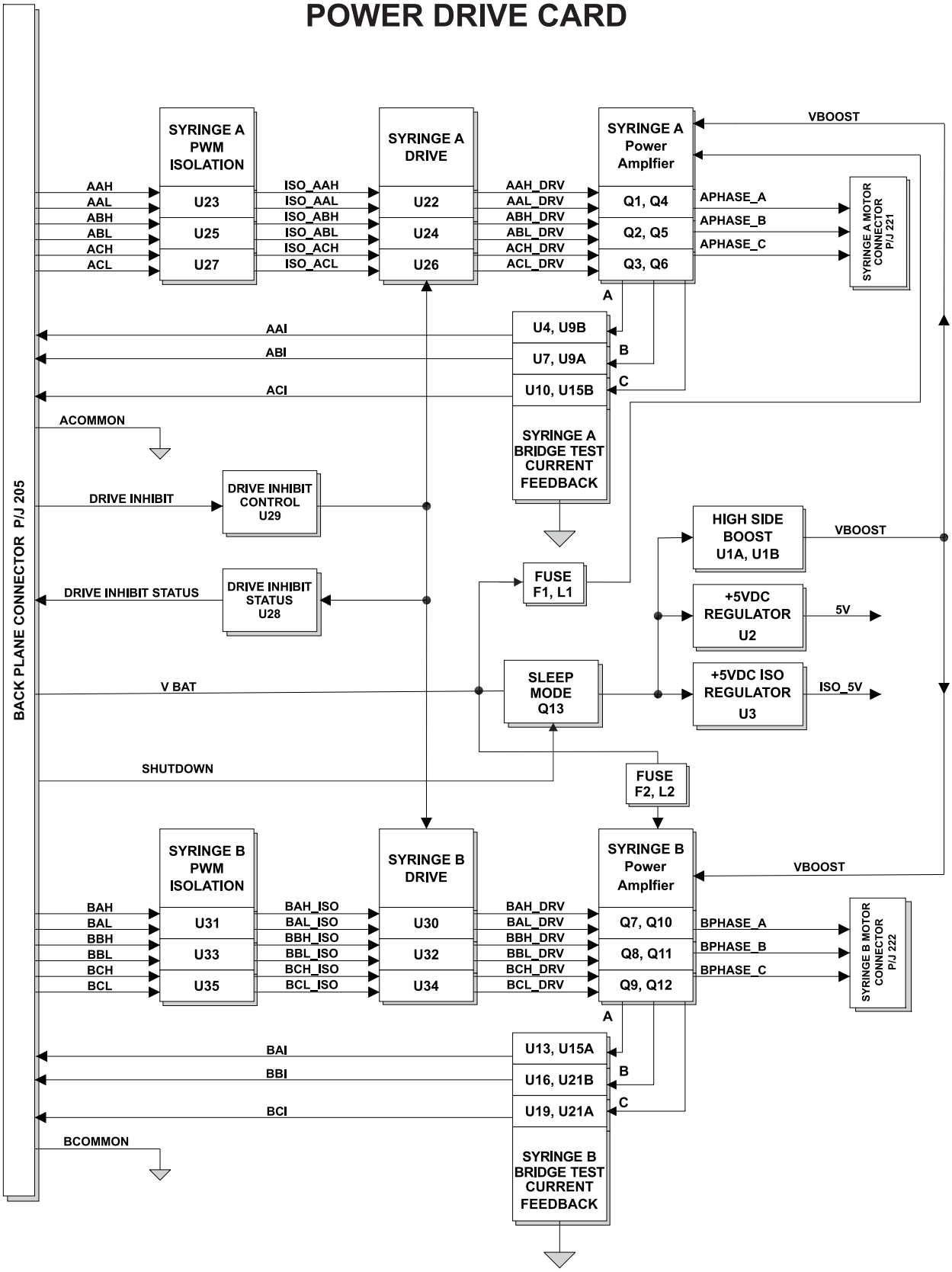


FIGURE 3

POWER DRIVE CARD



Power Drive Card - Block Diagram Description

SYRINGE A PWM ISOLATION
This block provides electrical isolation of the Pulse Width Modulation (PWM) switching signals for Syringe A. These signals are generated on the Servo/CPU Card via DSP A and are used to command and control the power amplifier current delivery to the motor.

SYRINGE B PWM ISOLATION
This block provides electrical isolation of the PWM switching signals for Syringe B. These signals are generated on the Servo/CPU Card via DSP B and are used to command and control the power amplifier current delivery to the motor.

SYRINGE A DRIVER
The Syringe A Driver stage is responsible for doing voltage translation and current capacity enhancement to the PWM signals for the Syringe A motor. Once the PWM signals have passed through the isolation barriers, they are routed to the Driver circuits. It is the responsibility of the Driver to translate the 0-5V PWM signals, to 0-12V on the low channels, and 0-12V plus boost voltage on the high side. The Driver has the capacity of sinking and sourcing high switching currents normally associated with power FET's. The Drive Inhibit signal is used to disable the Driver output signals. When Drive Inhibit is high, the outputs are disabled, and when low, the outputs are enabled. The Driver has built-in shoot-through protection to inhibit high side and low side outputs from being turned on simultaneously.

SYRINGE B DRIVER
The Syringe B Driver stage is responsible for doing voltage translation and current capacity enhancement to the PWM signals for the Syringe B motor. Once the PWM signals have passed through the isolation barriers, they are routed to the Driver circuits. It is the responsibility of the Driver to translate the 0-5V PWM signals, to 0-12V on the low channels, and 0-12V plus boost voltage on the high side. The Driver also has the capacity of sinking and sourcing high switching currents normally associated with power FET's. The Drive Inhibit signal is used to disable the Driver output signals. When Drive Inhibit is high, the outputs are disabled, and when low, the outputs are enabled. The Driver has built-in shoot-through protection to inhibit high side and low side outputs from being turned on simultaneously.

SYRINGE A POWER AMPLIFIER
The Syringe A Power Amplifier is configured in a 3-phase bridge arrangement comprising six N-Channel Enhancement mode power FETs. Each bridge leg is configured in a high, low arrangement with a motor phase (A,B, or C) tapped at the junction of the upper and lower power FET. The function of the Syringe A Power Amplifier is to convert the low level PWM signals from DSP A on the Servo/CPU, to high current motor signals that are used for the excitation of the stator windings of the Syringe A BLDC motor. The switching rate for the Power Amplifier is approximately 16 KHz. The input to the power amps is protected by a 12 A pico fuse.

SYRINGE B POWER AMPLIFIER
The Syringe B Power Amplifier is configured in a 3-phase bridge arrangement comprising 6 N-Channel Enhancement mode power FETs. Each bridge leg is configured in a high, low arrangement with a motor phase (A,B, or C) tapped at the junction of the upper and lower power FET. The function of the Syringe B Power Amplifier is to convert the low level PWM signals from DSP B on the Servo/CPU, to high current motor signals that are used for the excitation of the stator windings of the Syringe B BLDC motor. The switching rate for the Power Amplifier is approximately 16 KHz. The input to the power amps is protected by a 12 A pico fuse.

DRIVE INHIBIT CONTROL
This block provides shutdown control of Syringe A and Syringe B Drivers, which in turn disable the Syringe A and B Power Amplifiers. This signal is generated on the Servo/CPU Card and is passed through optical isolation circuitry where it is applied to the Shutdown pins of all drivers. When Drive Inhibit is active, the outputs of all drivers are disabled.

DRIVE INHIBIT STATUS
This block is a feedback to the Servo/CPU Card as to the status of the Drive Inhibit signal. This signal is optically isolated from the drive section of the board.

SYRINGE A BRIDGE CURRENT TEST FEEDBACK
This block is responsible for measuring, isolating and filtering each Syringe A Power Amplifier bridge node voltage. The rationale is: During bridge testing, these nodes will provide vital voltage information back to the Servo/CPU Card on the status of the bridge and motor windings. By exploiting the resonant frequency of the motor windings series inductance and distributed capacitance, each phase of the bridge can be excited with a single, short duration pulse. These pulses would be long enough to induce current into the motor windings but not long enough to produce motion. By observing the voltage at each node during excitation, the status of both the bridge and motor windings can be ascertained.

SYRINGE B BRIDGE CURRENT TEST FEEDBACK
This block is responsible for measuring, isolating and filtering each Syringe B Power Amplifier bridge node voltage. The rationale is: During bridge testing, these nodes will provide vital voltage information back to the Servo/CPU Card on the status of the bridge and motor windings. By exploiting the resonant frequency of the motor windings series inductance and distributed capacitance, each phase of the bridge can be excited with a single, short duration pulse. These pulses would be long enough to induce current into the motor windings but not long enough to produce motion. By observing the voltage at each node during excitation, the status of both the bridge and motor windings can be ascertained.

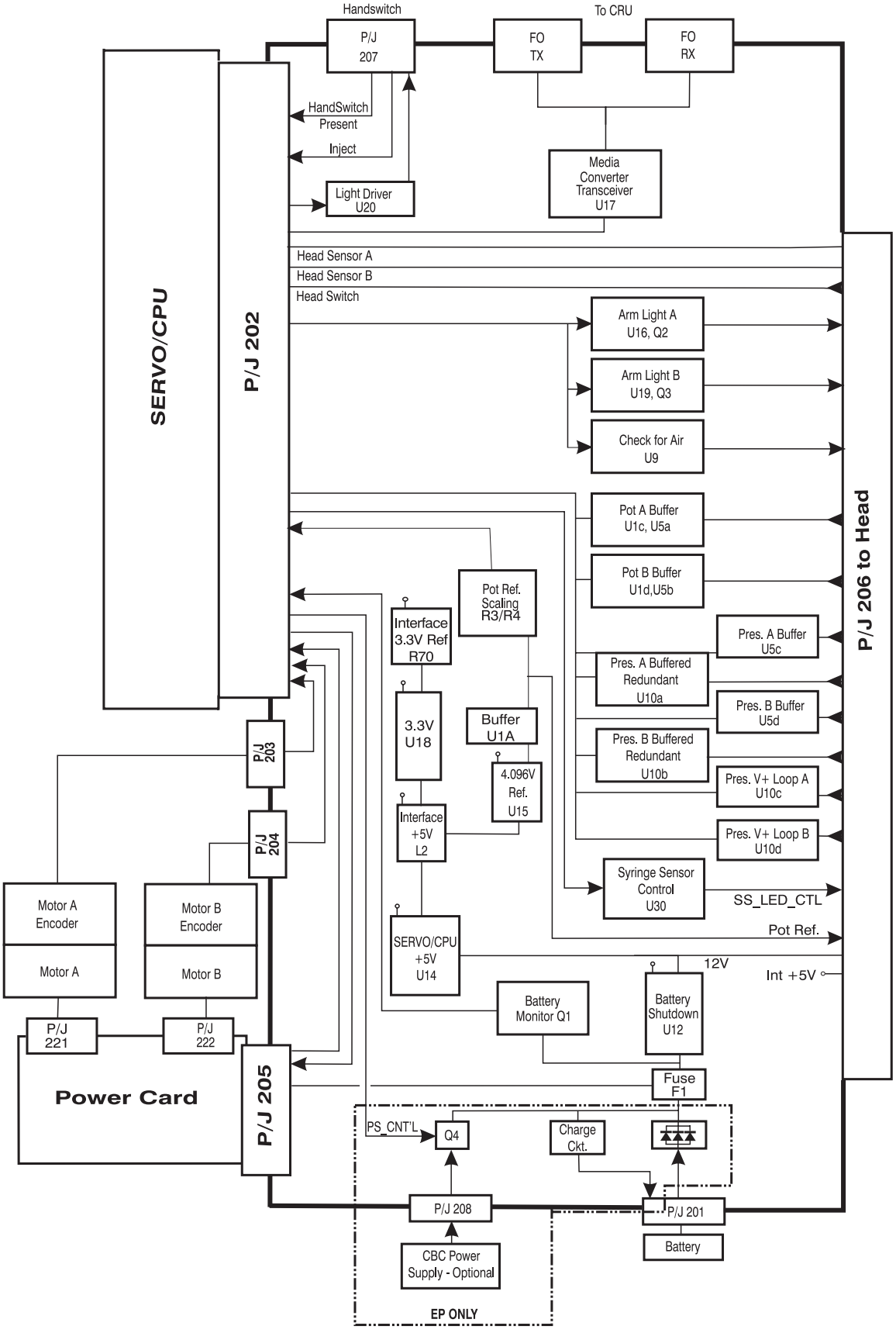
HIGH SIDE BOOST
The purpose of the HIGH SIDE BOOST block is to generate a floating voltage that is applied to the high-side FET gates at the Driver stage of both axes. This voltage (VBOOST) allows the gate voltage of the high side FETs to remain elevated above the source voltage when that particular leg of the bridge is sourcing motor current.

+5VDC REGULATOR
This block provides 5VDC power to the motor side of the following subsystems for both Syringe A and B axes: Bridge Test Current Feedback, PWM Isolation, Drivers.

+5VDC ISO REGULATOR
This block provides isolated 5VDC power to the Servo/CPU side of the following subsystems for both Syringe A and B axes: Bridge Test Current Feedback, PWM Isolation, Drivers.

SLEEP MODE
A low on the shutdown signal places the Power Drive Card in sleep mode. During sleep mode, VBAT is removed from the two +5 VDC linear regulators and the VBoost circuit.

Stand Base Interface Card Block Diagram



Stand Base Block Circuit Descriptions

Stand Base Interface Card
The Stand Base Interface Card is the electrical interconnect point between the Power Drive Card, Servo/CPU Card, head electronics, battery, iCBC Power Supply, and communication to the Control Room Unit.

Servo/CPU +5V Regulator
This circuit uses a +5VDC switching regulator to produce +5V at 3.0 Amps supply voltage for the Servo/CPU Card.

Interface +5V Regulator
This circuit filters the CPU +5VDC to supply voltage for the Stand Base Interface Card and Head.

+3.3V Regulator
This circuit uses a +3.3 VDC linear regulator to produce +3.3 VDC supply to feed the digital circuitry on the Stand Base Interface Card. This voltage is derived from +5 VDC.

POT_REF Regulator
This circuit uses a +4.096VDC reference to produce the +4.096V at 0.05 Amps reference voltage for the potentiometers. This voltage is derived from +5 VDC.

Motor Encoders / Commutation Tracks (both A & B)
This circuit provides the interface between the motor encoders/commutation and the Servo/CPU Card and provides the necessary signal conditioning (i.e. +5V pull-ups). The encoders are fed through the Stand Base Interface Card then directly to the Servo/CPU Card. The motor power comes straight from the Power Drive Card.

Media Converter
The Media Converter circuit converts standard 10Base-T Ethernet over Copper to 10Base-FL Ethernet over fiber and vice-versa for communication to the Control Room Unit.

Start Switch Interface
Start Switch signals are conditioned and routed to the Servo/CPU Card through the Stand Base Interface Card. The signals are fed through a set of normally open and normally closed contacts along with the Hand Switch Present line.

Hand Switch Arm Light Drive
Hand Switch Arm Light drive signal comes from the Servo/CPU Card to a driver on the Stand Base Interface Card.

Battery Monitor
This circuit scales the battery voltage so it can be read by the Servo/CPU Card.

Battery Shutdown
This circuit turns the 12 VDC supply off once the voltage drops below 10.8 VDC +/- 0.5 VDC protecting the battery from being deeply discharged. This circuit is enabled only when the injector is in low-power (sleep) mode.

Arm Lamp A Drive
The A arm lights drive signal comes from the Servo/CPU Card to a driver on the Stand Base Interface Card. This signal is routed to the A-Arm lamps via the head cable.

Arm Lamp B Drive
The B arm lights drive signal comes from the Servo/CPU Card to a driver on the Stand Base Interface Card. This signal is routed to the B-Arm lamps via the head cable.

Head Switches
The interface card provides a path for the load/enable switches from the head cable to the Servo/CPU. Each switch line is pulled up to 3.3 V.

Check For Air Indicator Driver
The Check For Air indicator drive signal comes from the Servo/CPU Card to a driver on the Stand Base Interface Card. This signal is routed to the switch card via the head cable.

Potentiometer A Buffers
The Pot A signals are routed from the head cable to the Servo/CPU. This signal is buffered and filtered on the Stand Base Interface Card before being routed to the Servo/CPU.

Potentiometer B Buffers
The Pot B signals are routed from the head cable to the Servo/CPU. This signal is buffered and filtered on the Stand Base Interface Card before being routed to the Servo/CPU.

Pressure A V+ Loopback
This signal monitors a reference voltage from the top of the pressure bridge. The reference is an output from the Head Sensor Card and is buffered before being sent to the Servo/CPU Card, where it is monitored as a critical voltage.

Pressure B V+ Loopback
This signal monitors a reference voltage from the top of the pressure bridge. The reference is an output from the Head Sensor Card and is buffered before being sent to the Servo/CPU Card, where it is monitored as a critical voltage.

Pressure A Buffered
The signal from the pressure bridge is fed back to the Servo/CPU Card but is buffered and filtered on the Stand Base Interface Card.

Pressure B Buffered
The signal from the pressure bridge is fed back to the Servo/CPU Card but is buffered and filtered on the Stand Base Interface Card.

Integrated Continuous Battery Charging (iCBC) system
When the iCBC system power supply is installed, the power supply will charge the batteries and power the SRU in the low-power (sleep) and armed states. The power supply is disconnected from the SRU during an injection via the PS_CONTROL software control line, allowing the SRU to run from the batteries. Charging is resumed upon completion of the injection.

Servo/CPU Interface

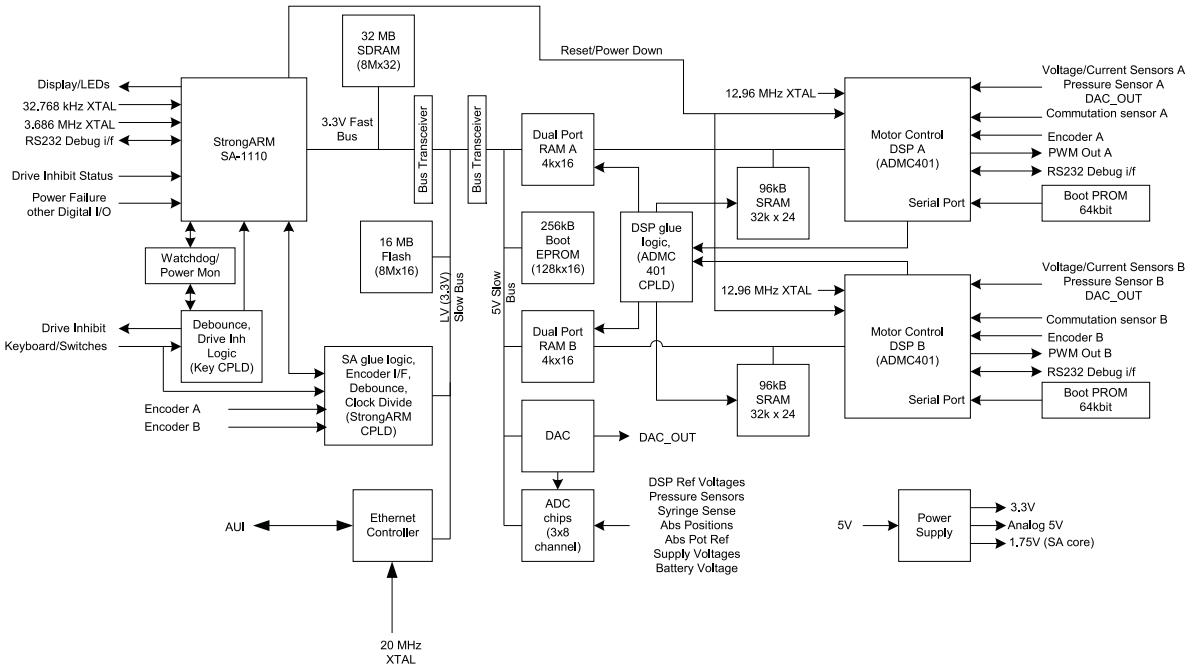
The interface card provides power and interface of all external I/O to the Servo/CPU Card. The Servo/CPU Card consists of:

- Intel StrongARM SA-1110 Processor
- 32 MB SDRAM
- 16 MB Flash
- 10 Mbit/s Ethernet
- 256 kB Boot EPROM
- Analog inputs for system monitoring and feedback
- Debounced digital keypad inputs
- Two Analog Devices ADMC401 Motor Control DSP processors, supporting sensored control of two brushless DC motors.

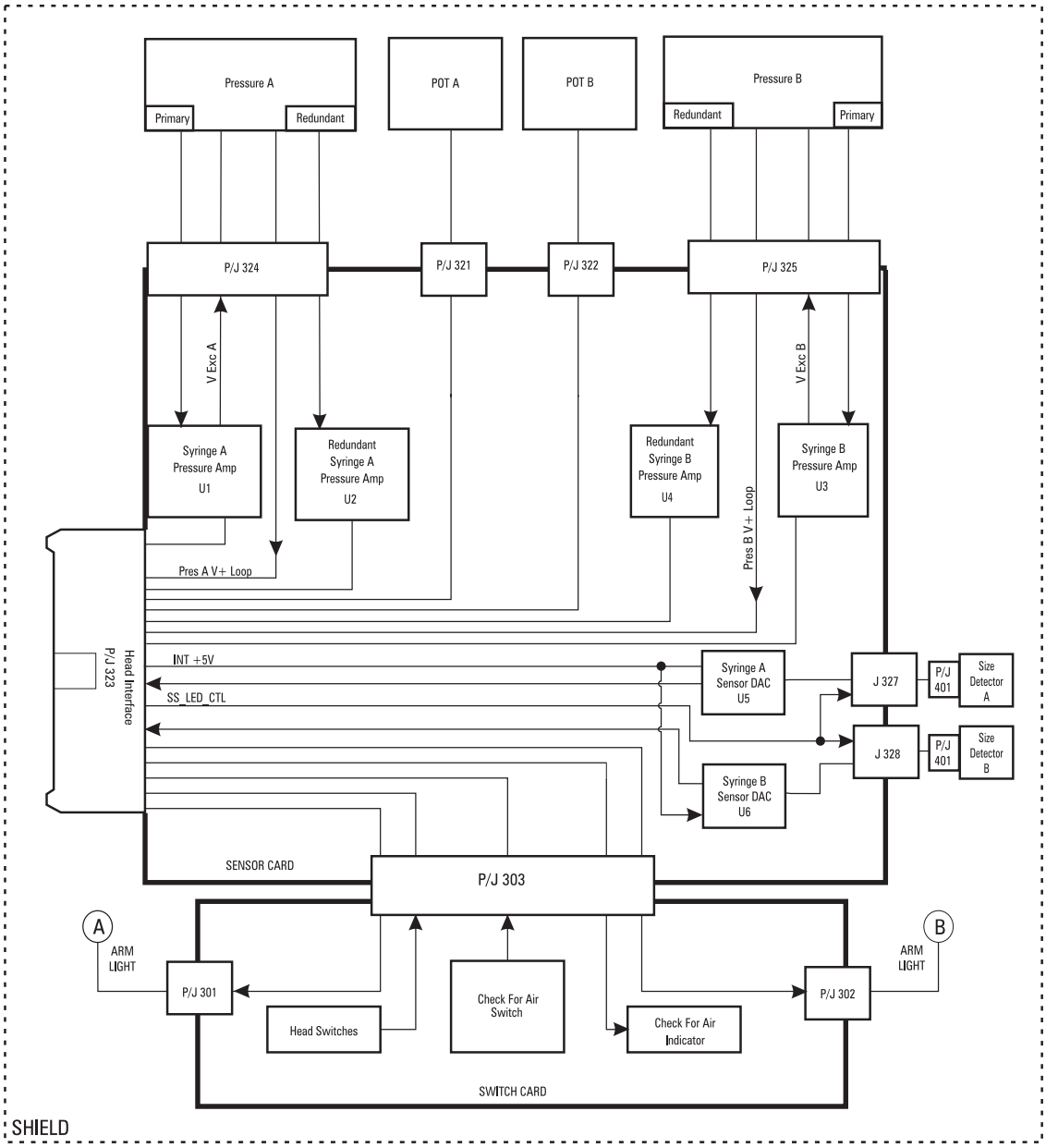
Power Drive Card Interface

The Stand Base Interface Card provides power and interface to the Servo/CPU Card. This card does not provide the power interface between the motor and the power card. Refer to the Power Drive Card block diagram for more information.

SERVO CPU CARD
(For reference only)



HEAD BLOCK DIAGRAM



Switch Card and Sensor Card - Block Diagram Descriptions

Arm Lamp A
The arm lights consist of 2 bulbs driven by the a driver on the Stand Base Interface Card.

Arm Lamp B
The arm lights consist of 2 bulbs driven by the a driver on the Stand Base Interface Card.

Head Switches
The load switches are 2 position switches that provides ground when closed back to the Servo/CPU Card via the Stand Base Interface Card. Each switch line is pulled up to 3.3 V. The enable switch is a single position switch.

Check For Air Switch
The check for air switch is a single position switch that provides ground when closed back to the Servo/CPU Card via the Stand Base Interface Card. The switch line is pulled up to 3.3 V.

Check For Air Indicator
The check for air lights consist of 4 Led mounted on the Switch Card. These are driven by the Check for Air driver on the Stand Base Interface Card.

Potentiometer A
The Pot provides an analog signal from 0 to 4.096VDC indicating the absolute position of the A piston on power up and serves as a backup to the A syringe encoder during a move. This signal is buffered and filtered in the Stand Base Interface Card and passed to the Servo/CPU Card.

Potentiometer B
The Pot provides an analog signal from 0 to 4.096VDC indicating the absolute position of the B piston on power up and serves as a backup to the B syringe encoder during a move. This signal is buffered and filtered in the Stand Base Interface Card and passed to the Servo/CPU Card.

Pressure A Syringe
This circuit uses a full Wheatstone bridge arrangement to produce a differential signal which corresponds to the force applied to the rear plate due to the pressure in the A side syringe. This signal is fed back to the Servo/CPU Card.

Redundant Pressure A Syringe
This circuit uses a full Wheatstone bridge arrangement to produce a differential signal which corresponds to the force applied to the rear plate due to the pressure in the A side syringe. This circuit provides a redundant backup to the pressure signal on the A syringe.

Pressure B Syringe
This circuit uses a full Wheatstone bridge arrangement to produce a differential signal, which corresponds to the force applied to the rear plate due to the pressure in the B side syringe. This signal is fed back to the Servo/CPU Card.

Redundant Pressure B Syringe
This circuit uses a full Wheatstone bridge arrangement to produce a differential signal, which corresponds to the force applied to the rear plate due to the pressure in the B-side syringe. This circuit provides a redundant backup to the pressure signal on the B syringe.

Syringe A Pressure Amplification
This circuit provides filtering and differential amplification of the Syringe A pressure reading and excitation voltage to the Primary and Redundant bridges.

Syringe A Redundant Pressure Amplification
This circuit provides filtering and differential amplification of the Syringe A redundant pressure reading.

Syringe B Pressure Amplification
This circuit provides filtering and differential amplification of the Syringe B pressure reading and excitation voltage to the Primary and Redundant bridges.

Syringe B Redundant Pressure Amplification
This circuit provides filtering and differential amplification of the Syringe B redundant pressure reading.

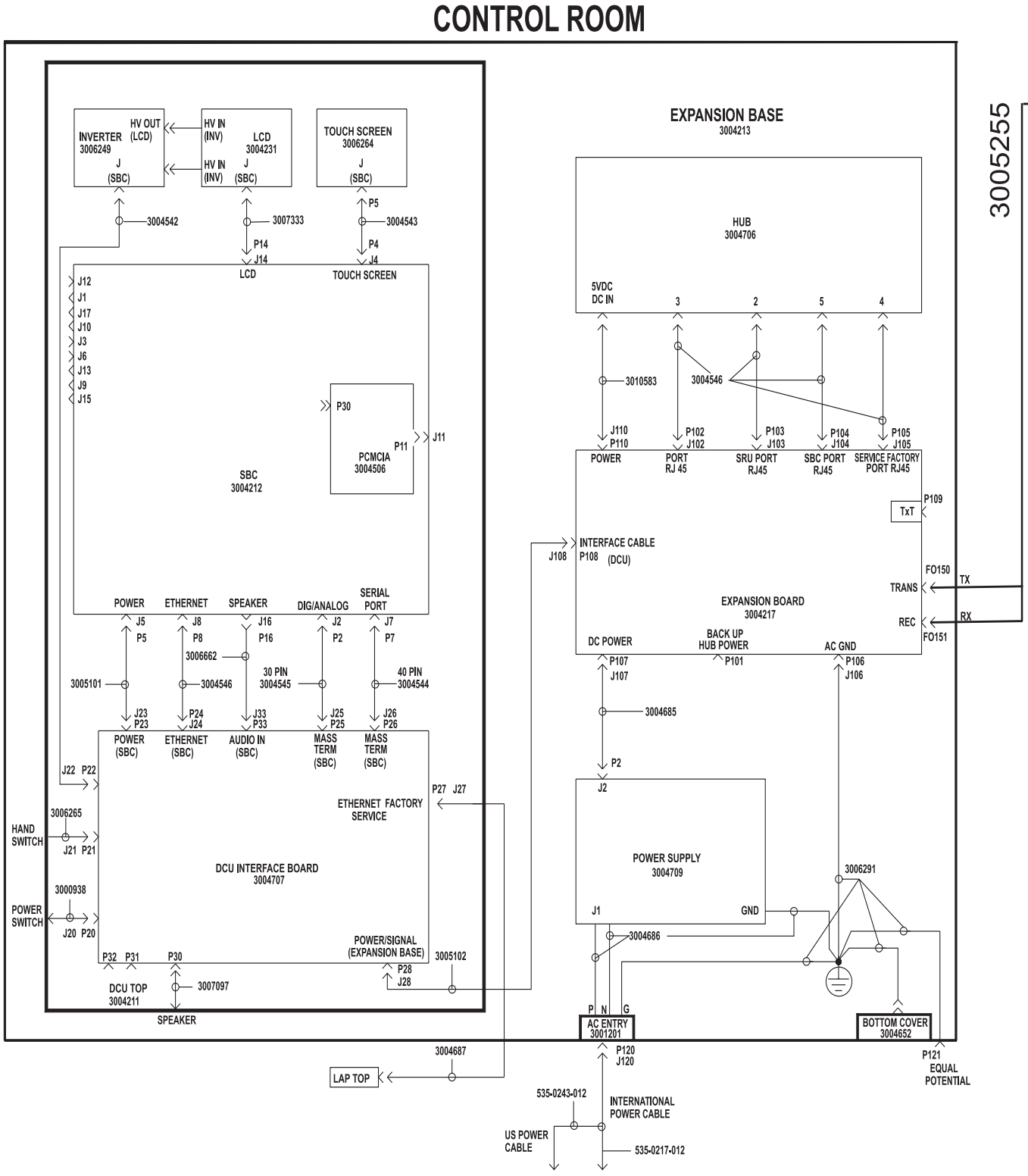
Head Interface
This connector provides the interface between the head and the rest of the system via the a head cable to the Stand Base Interface Card.

Syringe A Size Detector
This circuit is contained on the Syringe Size Detector (SSD) Card. It contains three “U” shaped photosensors that generate a high or low voltage depending on whether they are blocked or unblocked by the pin on the syringe interface. The signals from the three sensors are returned via a cable to the Head Sensor Card.

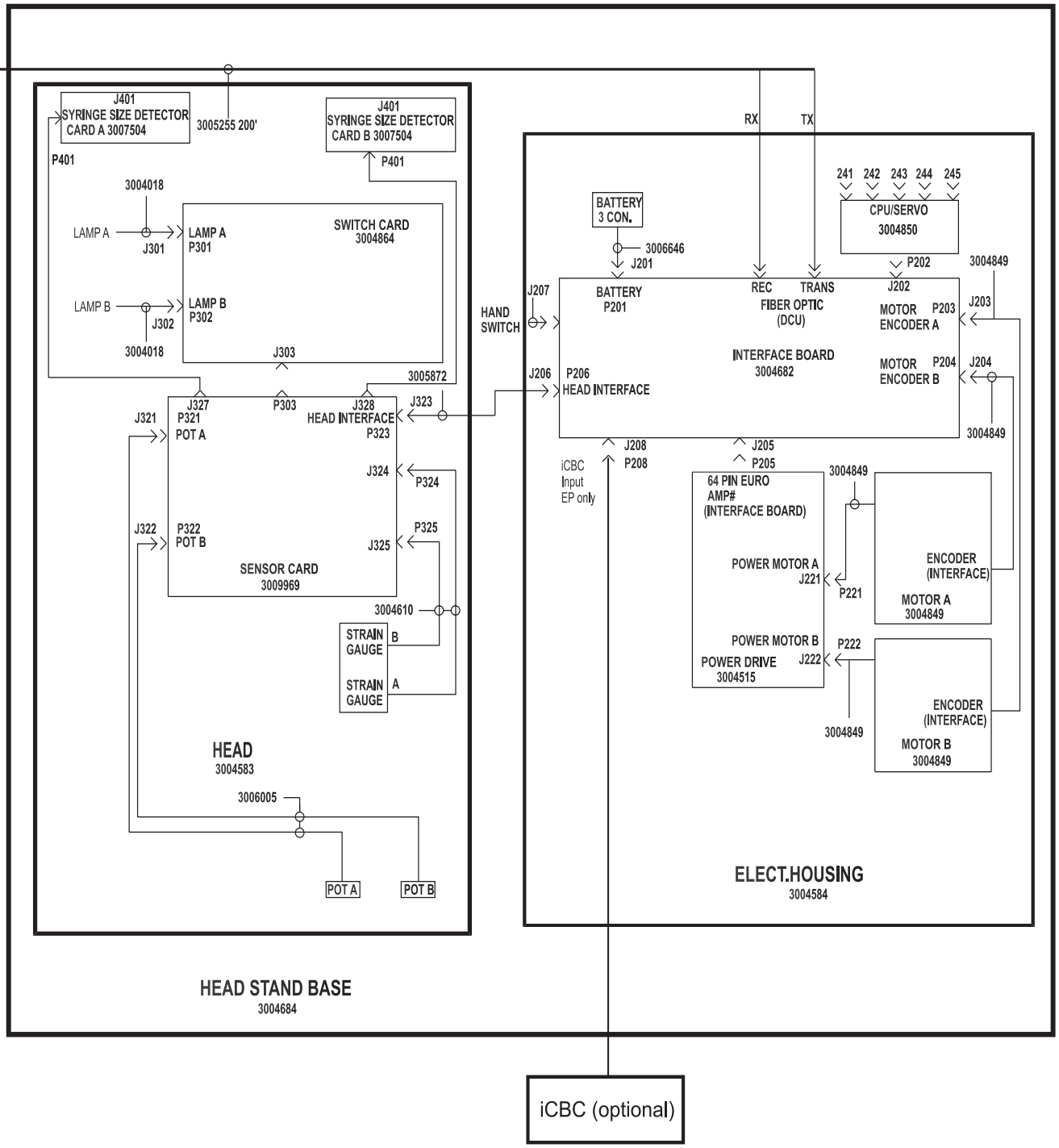
Syringe B Size Detector
This circuit is contained on the Syringe Size Detector (SSD) Card. It contains three “U” shaped photosensors that generate a high or low voltage depending on whether they are blocked or unblocked by the pin on the syringe interface. The signals from the three sensors are returned via a cable to the Head Sensor Card.

Syringe A Sensoring DAC
This circuitry utilizes a Digital-to-Analog Converter (DAC) to convert the digital input from three photosensors on the SDD Card into an analog voltage that is used by software to determine which syringe or adapter is inserted.

Syringe B Sensoring DAC
This circuitry utilizes a Digital-to-Analog Converter (DAC) to convert the digital input from three photosensors on the SDD Card into an analog voltage that is used by software to determine which syringe or adapter is inserted.


CONTROL ROOM
EXPANSION BASE
3004213
INVERTER
3006249
HV OUT (LCD)
HV IN (INV)
LCD
3004231
TOUCH SCREEN
3006264
3004542
3007333
3004543
P14
J14
P4
J4
LCD
TOUCH SCREEN
J12
J1
J17
J10
J3
J6
J13
J9
J15
P30
P11
J11
PCMCIA
3004506
SBC
3004212
POWER
ETHERNET
SPEAKER
DIG/ANALOG
SERIAL PORT
J5
P5
J8
P8
J16
P16
J2
P2
J7
P7
3006662
3005101
3004546
30 PIN
3004545
40 PIN
3004544
J23
P23
P24
J24
J33
P33
J25
P25
J26
P26
POWER (SBC)
ETHERNET (SBC)
AUDIO IN (SBC)
MASS TERM (SBC)
MASS TERM (SBC)
J22 P22
P27 J27
ETHERNET FACTORY SERVICE
3006265
HAND SWITCH
J21 P21
DCU INTERFACE BOARD
3004707
3000938
POWER SWITCH
J20 P20
P32 P31 P30
POWER/SIGNAL (EXPANSION BASE)
3005102
P28
J28
DCU TOP
3004211
3007097
SPEAKER
HUB
3004706
5VDC DC IN
3
2
5
4
3010583
3004546
J110
P110
P102
J102
P103
J103
P104
J104
P105
J105
POWER
PORT RJ 45
SRU PORT RJ45
SBC PORT RJ45
SERVICE FACTORY PORT RJ45
P109
TxT
INTERFACE CABLE
J108
P108
(DCU)
FO150
TRANS
TX
EXPANSION BOARD
3004217
REC
RX
FO151
DC POWER
BACK UP HUB POWER
AC GND
P107
J107
P101
P106
J106
3004685
P2
J2
POWER SUPPLY
3004709
3006291
J1
GND
3004686
P N G
AC ENTRY
3001201
BOTTOM COVER
3004652
P120
J120
P121
EQUAL POTENTIAL
3004687
LAP TOP
535-0243-012
INTERNATIONAL POWER CABLE
US POWER CABLE
535-0217-012
3005255

SCANNER ROOM



6 Replacement Parts

When troubleshooting the *Spectris Solaris* Injection System, it may be necessary to order replacement parts for a given assembly. This section contains information regarding individual assemblies of the system. Each primary assembly has a corresponding Parts List and Parts Diagram, specifying components that may require replacement.

When ordering replacement parts, contact MEDRAD Service, or your authorized MEDRAD dealer.

Parts Lists and Diagrams are arranged in the following sequence:

Control Room Monitor - Top Front
Control Room Monitor - Top Back
Control Room Monitor - Expansion Base
Head Stand Power/Motor/Elect. Housing Box - Sheet 1
Head Stand Power/Motor/Elect. Housing Box - Sheet 2
Head Stand Base
Head Stand Final
Head Top Cover
Head Bottom Cover
Miscellaneous

Parts List Components

Each Parts Lists contains the following information:

Item Number
This number refers to the labels of all items specified in the parts diagrams.

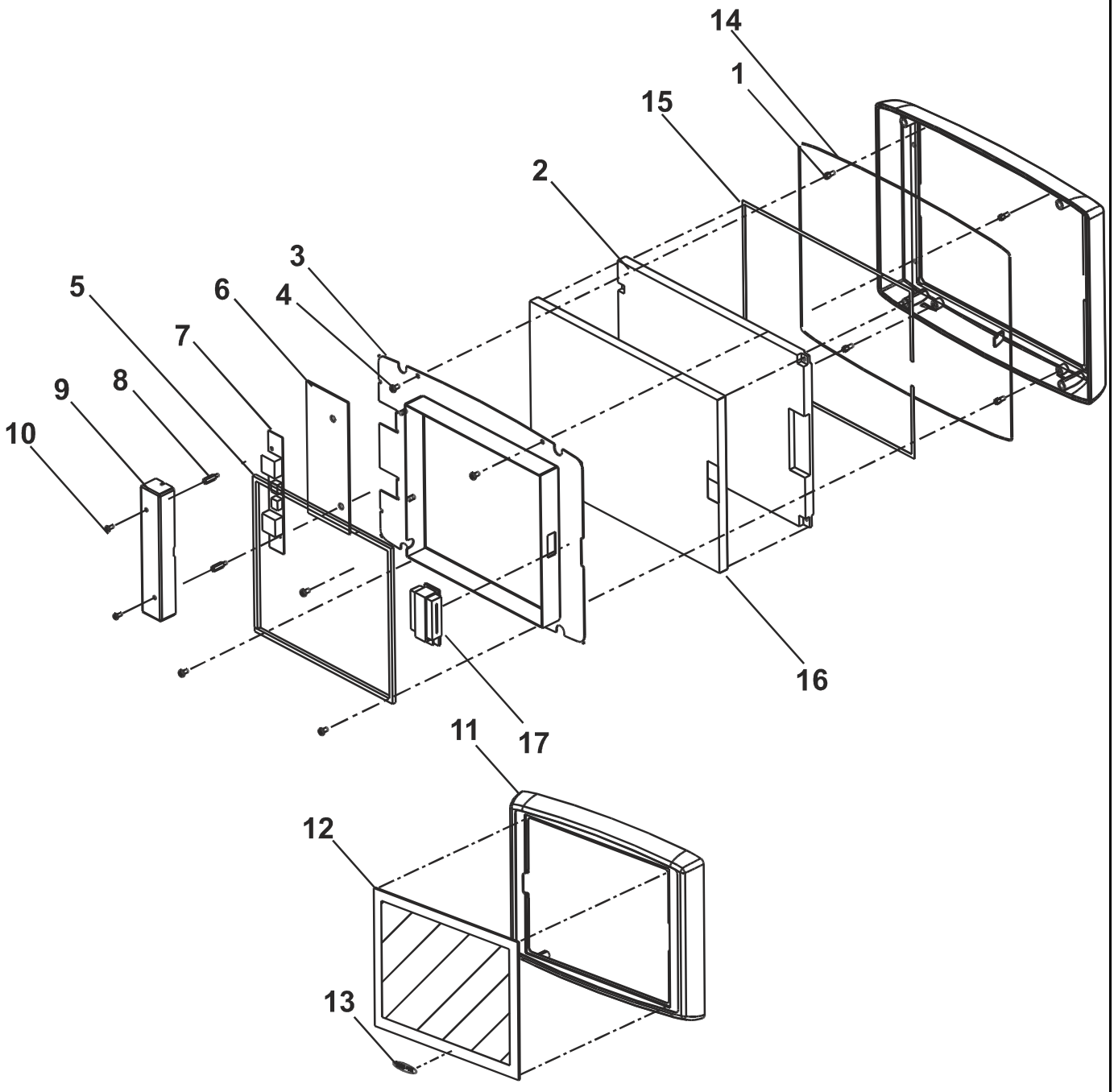
Part Description
This information, useful in part identification, is a brief description of all items specified in the parts diagrams.

Part Number
Used specifically for ordering purposes, these numbers are the primary designators of all system components, and should be used when ordering any MEDRAD replacement parts.

Quantity
This number represents the quantity of like pieces that are used in the represented assembly.

Control Room Monitor Top Front

Ref. No.	Part Description	Part Number	Qty.
1	Standoff	627-3636-632	4
2	Display, LCD, Color, TFT Sharp	3004231	1
3	Assembly, Shield, LCD	3004651	1
4	Screw, ZP, 6-32 x 3/16”	602-0632-316	4
5	Gasket, Shield Plate, Wall	3006395	1
6	Inverter Shield, Gasket	3006392	1
7	Inverter, PCB	3006249	1
8	Standoff, 4-40 x .5”	3006452	2
9	Shield Inverter	3004647	1
10	Screw, 4-40 x .25” PNH	602-0440-140	2
11	Bezel	3005271	1
12	Touchscreen Assembly - Solaris Touchscreen Assembly - Solaris EP	3008225 3012180	1 1
13	Label, Logo, Solaris Spectris	200486	1
14	Gasket Bezel	3007724	3.40’ (103.6 cm)
15	Foam Tape - 3/32” x 1/16”	714-3018-062	2.84’ (86.6 cm)
16	Shield (plastic)	3007787	1
17	Ferrite Flat	3007825	1
Not Shown:			
	Cable, Touchscreen to SBC	3004543	1
	Assembly, Cable, SBC to LCD	3007333	1
	Touchscreen Spacer	3006580	2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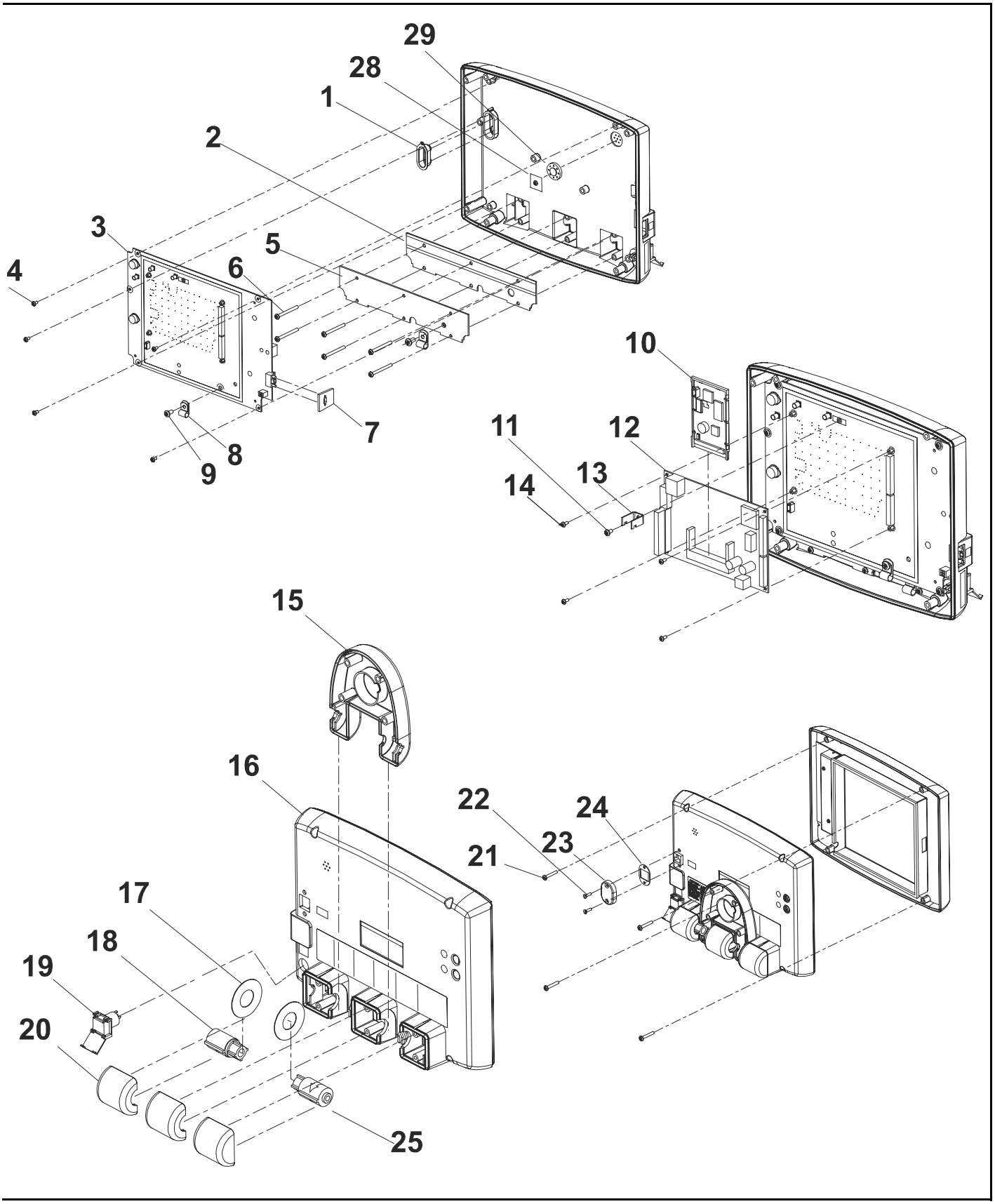
Control Room Monitor Top Back

Ref. No.	Part Description	Part Number	Qty.
1	Switch, Boot Brightness	3005273	1
2	Gasket, EMI/RFI, Hinge Plate	3006391	1
3	Interface, PCB	3004707	1
4	Screw, Machine, 6-32 x 1/4”	602-0632-140	5
5	Shield, Hinge Plate	3004649	1
6	Screw, Machine, 6-32 x 1/2”	602-0632-112	6
7	Micro-Dshield, 9 Pin, Gasket	3006394	1
8	Cable Clamp	3003511	1
9	Screw, 10-32 x 3/8”	602-0632-112	1
10	Assembly, PCB, PCMCIA	3004506	1
11	Screw, Machine, BR, 6-32 x 1/4”	602-0632-143	1
12	Assembly, PCB, Single Board Computer	3004212	1
13	PCMCIA, Retainer Bracket	3006351	1
14	Screw, 4-40 x 3/16”	602-0440-316	4
15	Swivel, Top, Display	3002209	1
16	Enclosure	3005272	1
17	Washer, Thrust, DCU	401001684	2
18	Hinge, Red	600-1000-002	1
19	Power Switch	3000938	1
20	Cap, Hinge, Display	3002208	3
21	Screw, 8-32 x 1”	602-0832-100	4
22	Screw, FH, 6-32 x 1/2”, Nylon	651-0632-123	2
23	Cover, RJ45 Connector, Plastic	3006335	1
24	Gasket, RJ 45 Cover	3006661	1
25	Hinge, Black	600-1000-001	1
26	Clamp, Cable	3003511	2
27	Screw, 10-32 x 3/8”	602-1032-380	2
28	Speaker Assembly	3007097	1
29	Speaker Hold-down	3007569	1

Not Shown:

Cable, Ribbon, IHV, Pwr	3004542	1
Cable, Pigtail (J28 - J108)	3005102	1
Assembly, Cable, Ribbon, 30 conductor (P2 - J25)	3004545	1
Assembly, Cable, Ribbon, 40 conductor (P7 - J26)	3004544	1
Assembly, Cable, Ethernet, 1.0 feet (P8 - P24)	3004546	1
Assembly, Cable, DC Power to SBC, DCU (P5 - J23)	3005101	1
Assembly, Cable, Audio, DCU (P16 - J33)	3006662	1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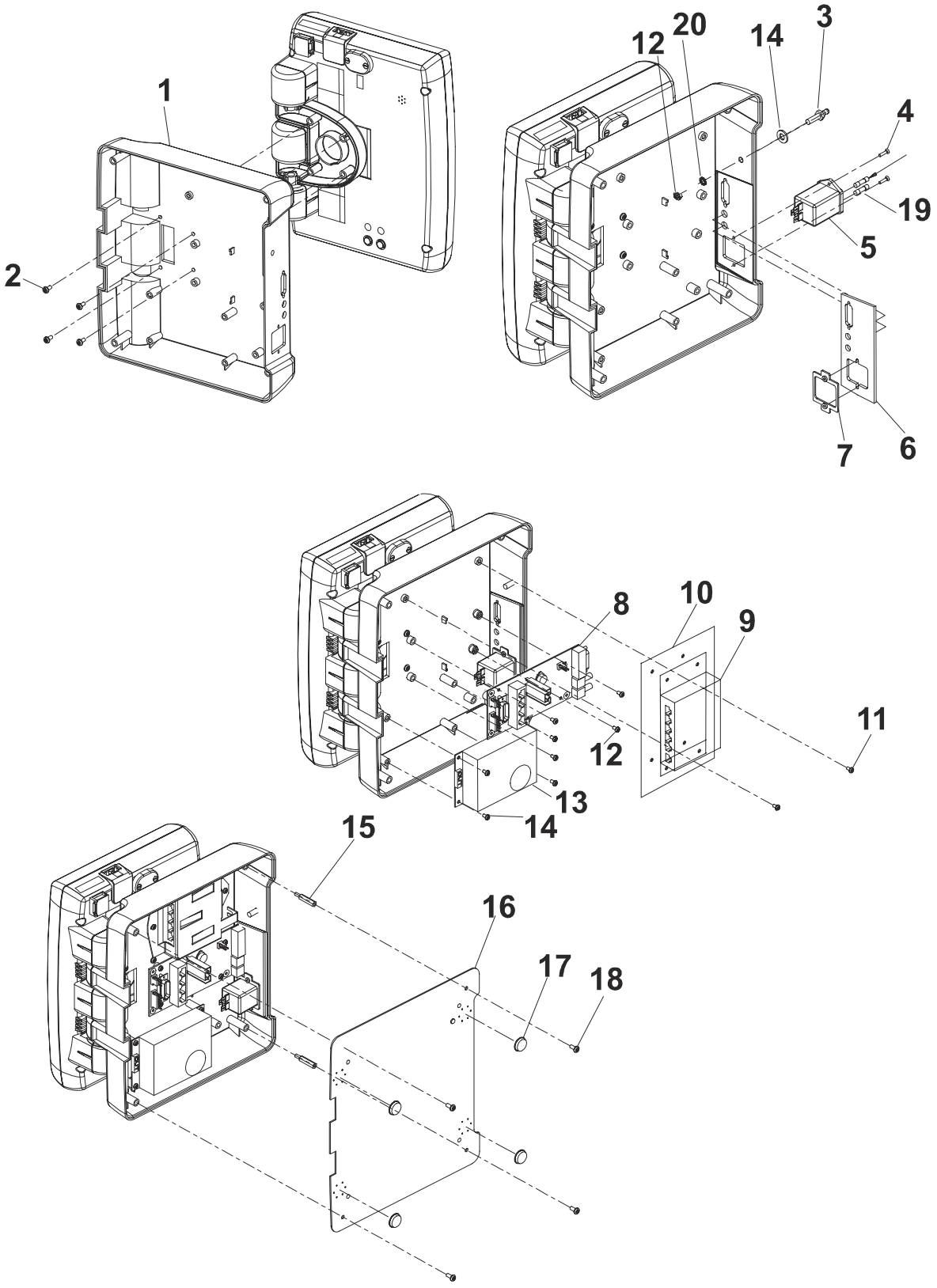
Control Room Monitor ***Expansion Base***

Ref. No.	*Part Description*	*Part Number*	*Qty.*
1	Enclosure, Expansion Base, Top	3004214	1
2	Screw, 8-32 x 3/8”	602-0832-380	4
3	Stud, Equal Potential	528-4057-001	1
4	Screw, Mach, FL HD, Phil, ZP, 4-40 x 1/2”	603-0440-120	2
5	Filter, Line, Power Module	3001201	1
6	Gasket, EMI/RFI, Multiconnector	3006396	1
7	Plate, Backing, AC Filter, MET	3004653	1
8	Assembly, PCB, Interface	3004217	1
9	Hub, Ethernet, 10 MPS, 4 Port	3010582	1
10	Bracket, Clamping, Hub, MET	3010521	1
11	Screw, Mach, Pan HD Slot, BR, 6-32 x 1/4”	603-0632-143	10
12	Nut, Stud	528-8501-001	2
13	Assembly, Power Supply	3009631	1
14	Washer, Green/Yellow	528-1430-001	1
15	Standoff, 8-32 x 1-1/2” M/F Studs	3007592	2
16	Plate, Access cover, Bottom, Metal	3004652	1
17	Foot Pad, Self Stick	600-5744-340	4
18	Screw, 8-32 x 3/8”	602-0832-380	4
19	Fuse Type F 250V, 2.5A	3001431	2
20	Washer, Lock	528-8704-001	1

Not Shown:

Bracket, Cable Retention	3004686	1
Clamp	3006121	1
Kit, Grounding	3006291	1
Cable, DC Power to HUB, EB (J110 - HUB)	3010583	1
Cable, Ethernet, 1.0 feet	3004536	4
Cable, AC Power and Ground, EB (Inlet to J1)	3004686	1
Cable, DC Power to PCB, EB (P2 - J107)	3004685	1
15 Pin Cover	3006176	1
Screw, 4-40 x 3/16”	602-0440-316	2
Cover Plate (holds 15 pin cover)	3003743	1
Cable, Ferrite	3004002	1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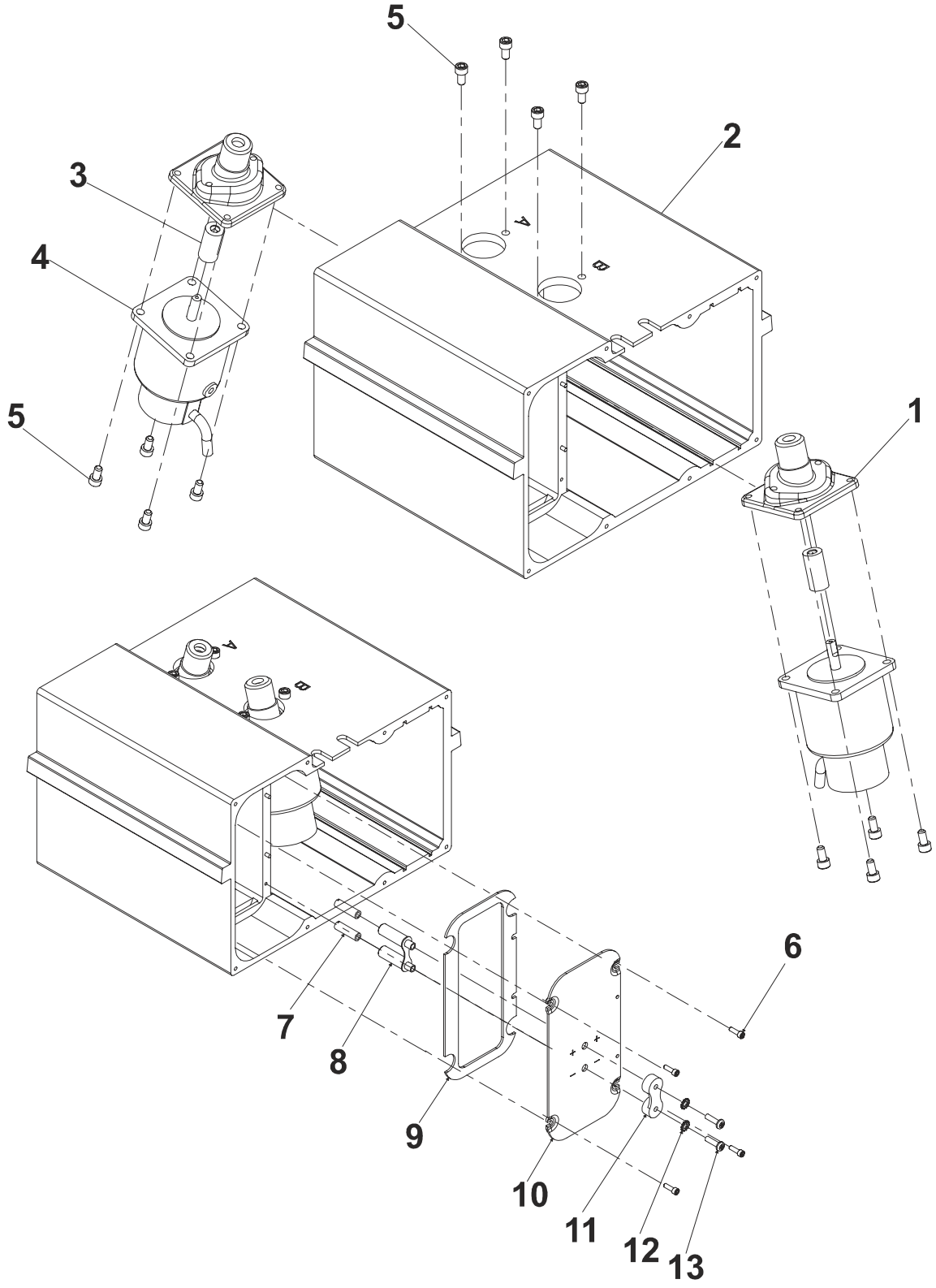
Head Stand Power Box

Ref. No.	Part Description	Part Number	Qty.
1	Mount, motor, angled, cast, machined	3005367	2
2	Housing, Electronic, Extrusion, Machined	3004564	1
3	Coupling, Flexshaft, MR Injector	901001080	2
4	Assembly, Motor	3004849	2
5	Screw, SST, 10-32 x 3/8”	3006083	12
6	Screw, SKT HD CAP, SST, 4-40 x 3/8” Yellow	614-0440-389	4
7	Jack, Banana, STD, Female, EX Hook 8206	503-8206-632	2
8	Shield, Banana Jack	901001077	1
9	Assembly, Gasket Set, Housing Electronic	3006306	1
10	Plate, Back, Battery, Housing Electronic	3004582	1
11	Insulator, Connector, Banana Jack	901001078	1
12	Washer, Lock #6, External, Silver Bronze	606-0006-001	2
13	Screw, 6-32 x 1/2”	602-0632-129	2

Not Shown:

Assembly, Wiring Harness, battery, (Battery - J222)	3006646	1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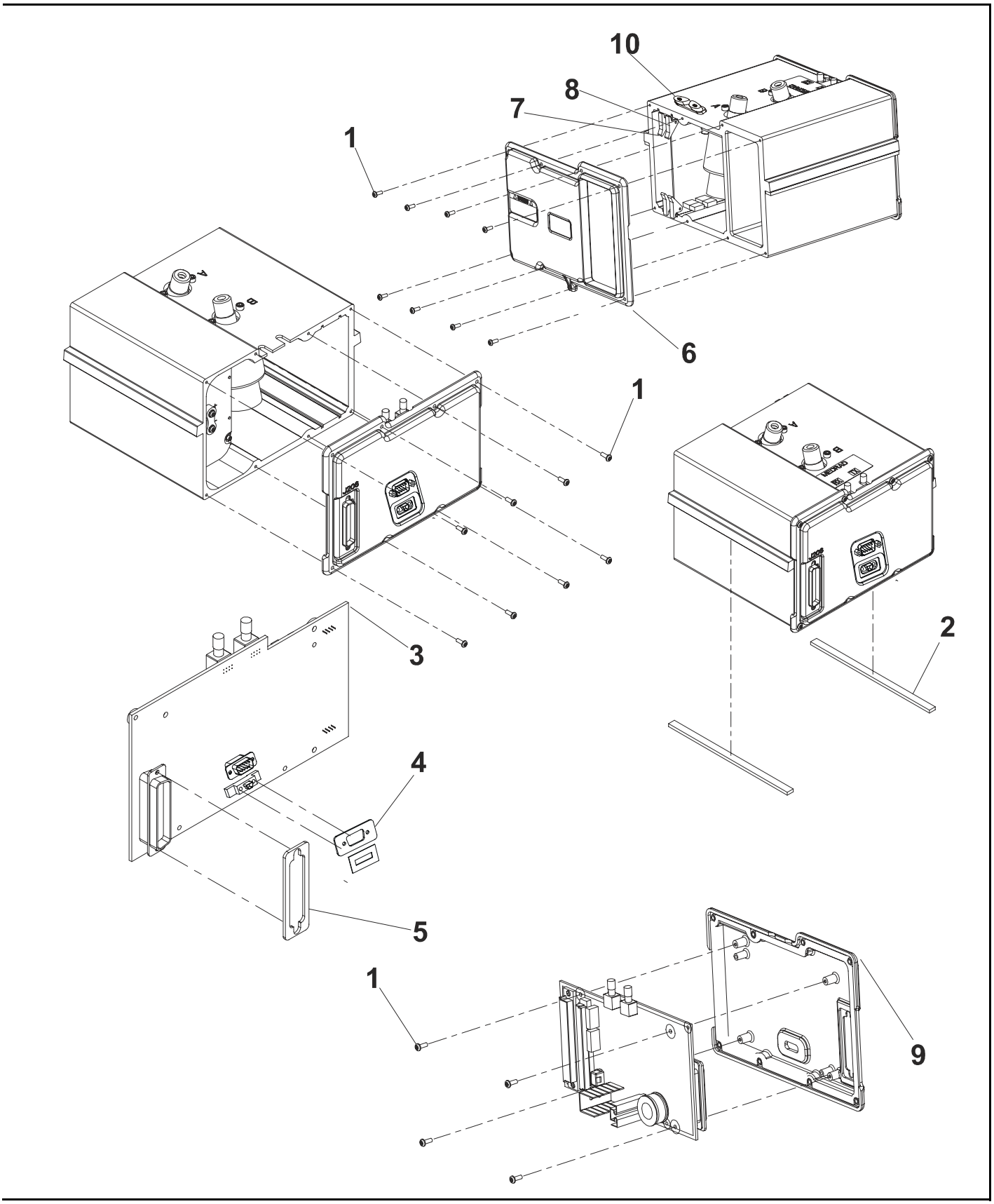
Head Stand Power Box

Ref. No.	Part Description	Part Number	Qty.
1	Screw, SST, 6-32 x 3/8”, PAN, PHL, Yellow	3005960	20
2	Rubber, Sponge, Natural, 5/32” x 38”	3006281	15” (38.1 cm)
3	Assembly, PCB, Interface, Stand, Base-Solaris	3004682	1
	Assembly, PCB, Interface, Stand, Base-Solaris EP	3011942	1
4	Gasket, EMI/RFI, 9-Pin D-Sub	3006394	1
5	Gasket, EMI/RF, Electropad, ‘D’, 50 Pin	3006370	1
6	Plate, front, HSG, Electronic, Machined	3004565	1
7	Assembly, PCB, CPU/Servo	3004850	1
8	Assembly, PCB, Power Drive, MR-Solaris	3004515	1
	Assembly, PCB, Power Drive, MR-Solaris EP	3012064	1
9	Plate, rear-Solaris	3004567	1
	Plate, rear-Solaris EP	3011960	1
10	Cleat, cable	3008687	1

Not Shown:

Label, Warning Explosion Hazard/High Voltage	201149	1
Front Gasket and Rear Gasket	3006306	1
Tape, foam, Gray 1/2” x 1/8”	714-4508-002	2” (5.1 cm)
Screw, 8-32 x 1.25”	3008686	2
Gasket connector on SBIC	3012037	1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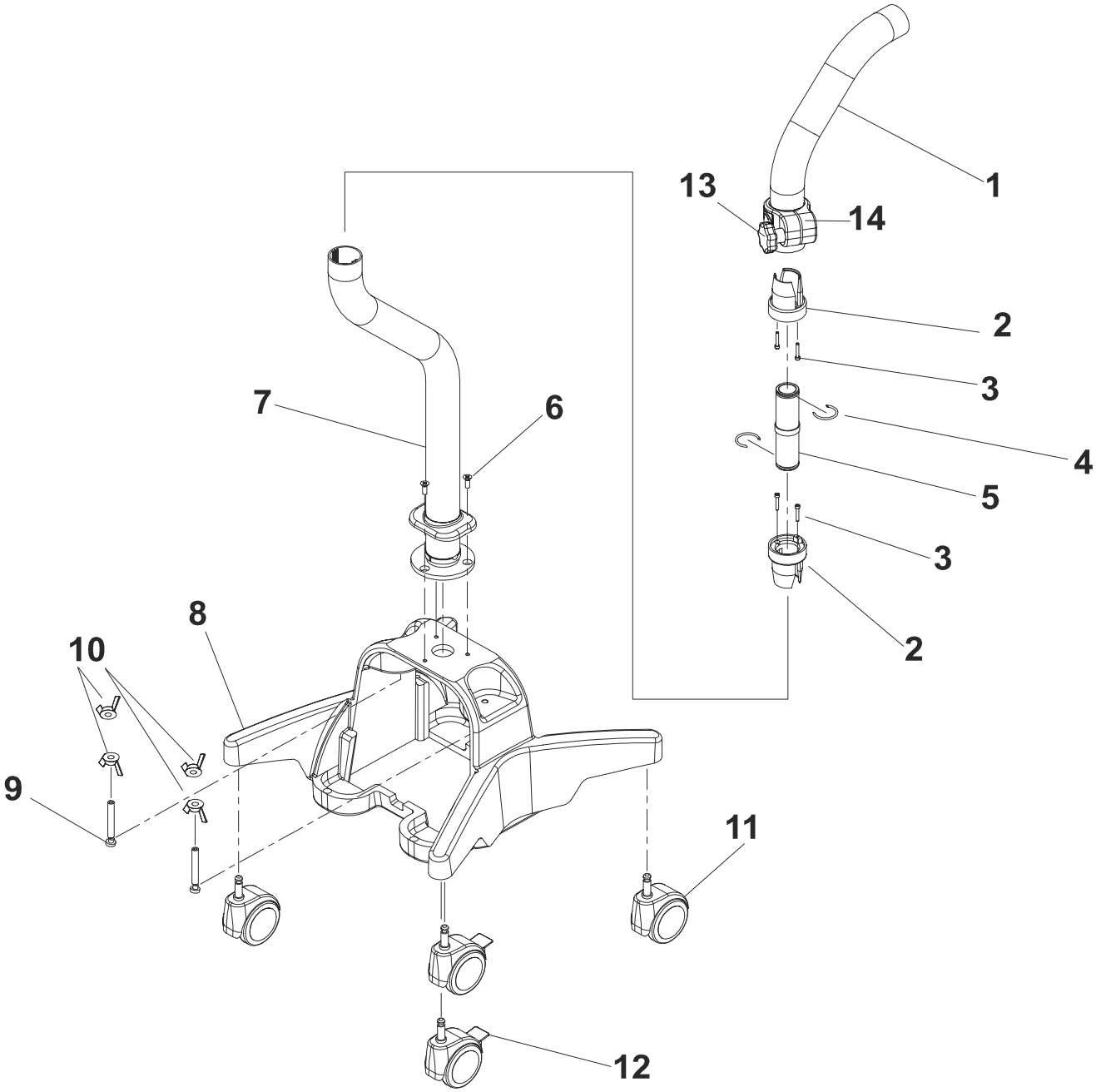
HSU ***(Stand Assembly)***

Ref. No.	*Part Description*	*Part Number*	*Qty.*
1	Tube, Support Arm	901001044	1
2	Bushing	901001133	1
3	Screw, 8-32 x 0.625”	3001561	4
4	C-Clip	645-1226-118	2
5	Pivot, Middle	901001132	1
6	Screw, 1/4-20 x 3/4”	3006088	2
7	Tube, Upright	3004593	1
8	Base	3004569	1
9	Hold Down Bolts	3006613	2
10	Wing Nuts	3006087	4
11	Caster, Non-Locking	3006523	2
12	Caster, Locking	3006524	2
Spectris Solaris EP Only:			
13	Knob	3012530	1
14	Head Pivot Clamp	3012214	1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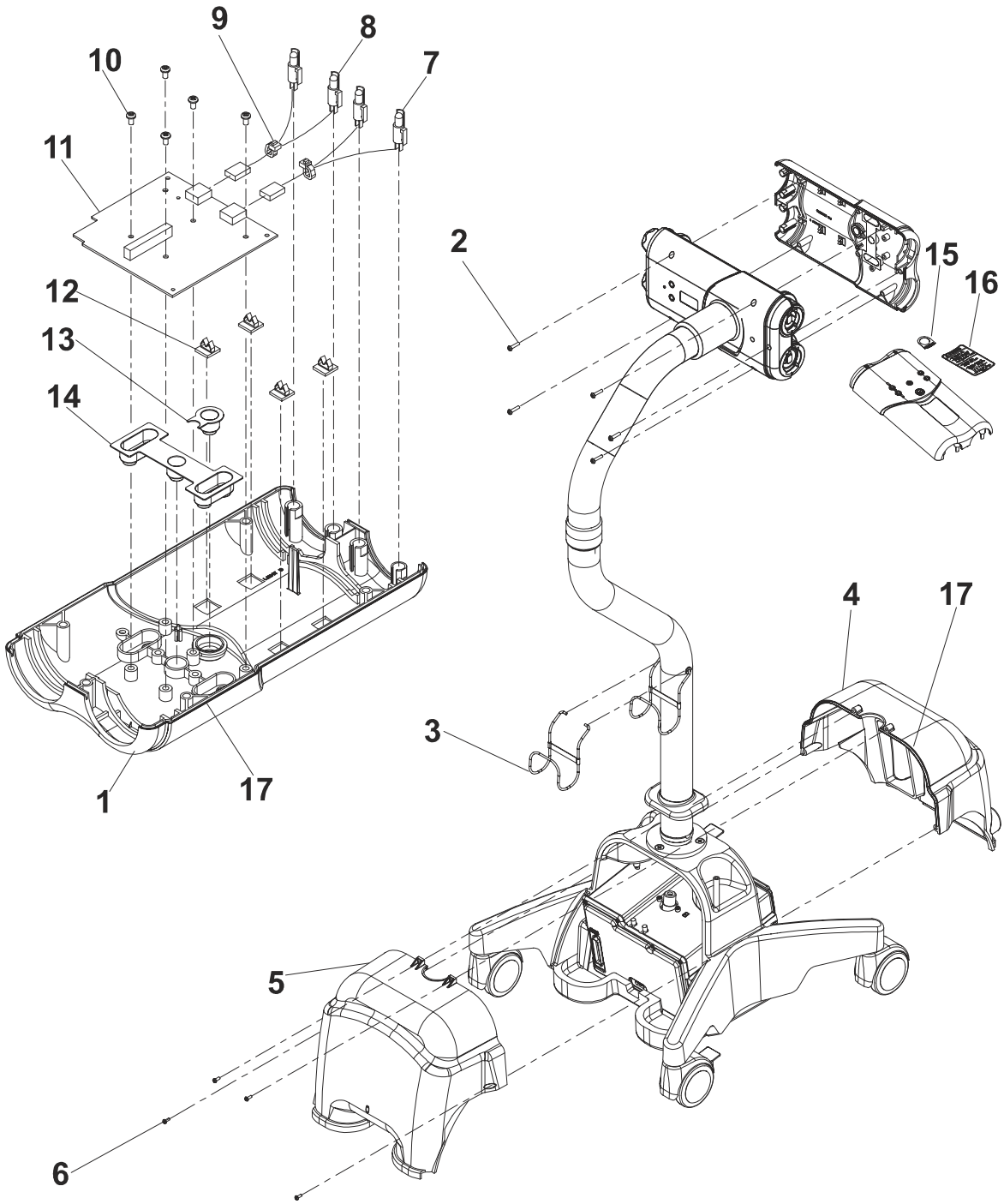
Stand/Head

Ref. No.	Part Description	Part Number	Qty.
1	Top cover - Solaris EP	3012178	1
	Top cover - Solaris	3004512	1
2	Screw, 8-32 x 5/8”	602-0832-589	5
3	Hanger	3004588	1
4	Front Cover	3004570	1
5	Rear Cover - Solaris EP	3011959	1
	Rear Cover - Solaris	3004581	1
6	Screw, 6-32 x 3/8”	3005960	4
7	Arm Light bulb	481-0037-014	4
8	Arm Light Assembly with Bulb	3004018	2
9	Cable Tie	715-0096-003	2
10	Screw 6-32 x 1/4”	602-0632-149	5
11	Switch Card	3004864	1
12	Cable Tie Mount	715-0301-500	4
13	Check for Air Boot	3006227	1
14	Key Pad Boot	901001111	1
15	Check for Air Label (English)	200451	1
16	Warning Label (English)	92901-T-111	1
17	Gasket	3001882	2

Not Shown:

Head Cable (J206 - J323)	3005872	1
Flex Shaft Casings	3004679	2
Flex Shafts	3004678	2
A/B Label	92901-T-109	1
Label, Apply Brakes	200453	2
Ferrites	3009965	2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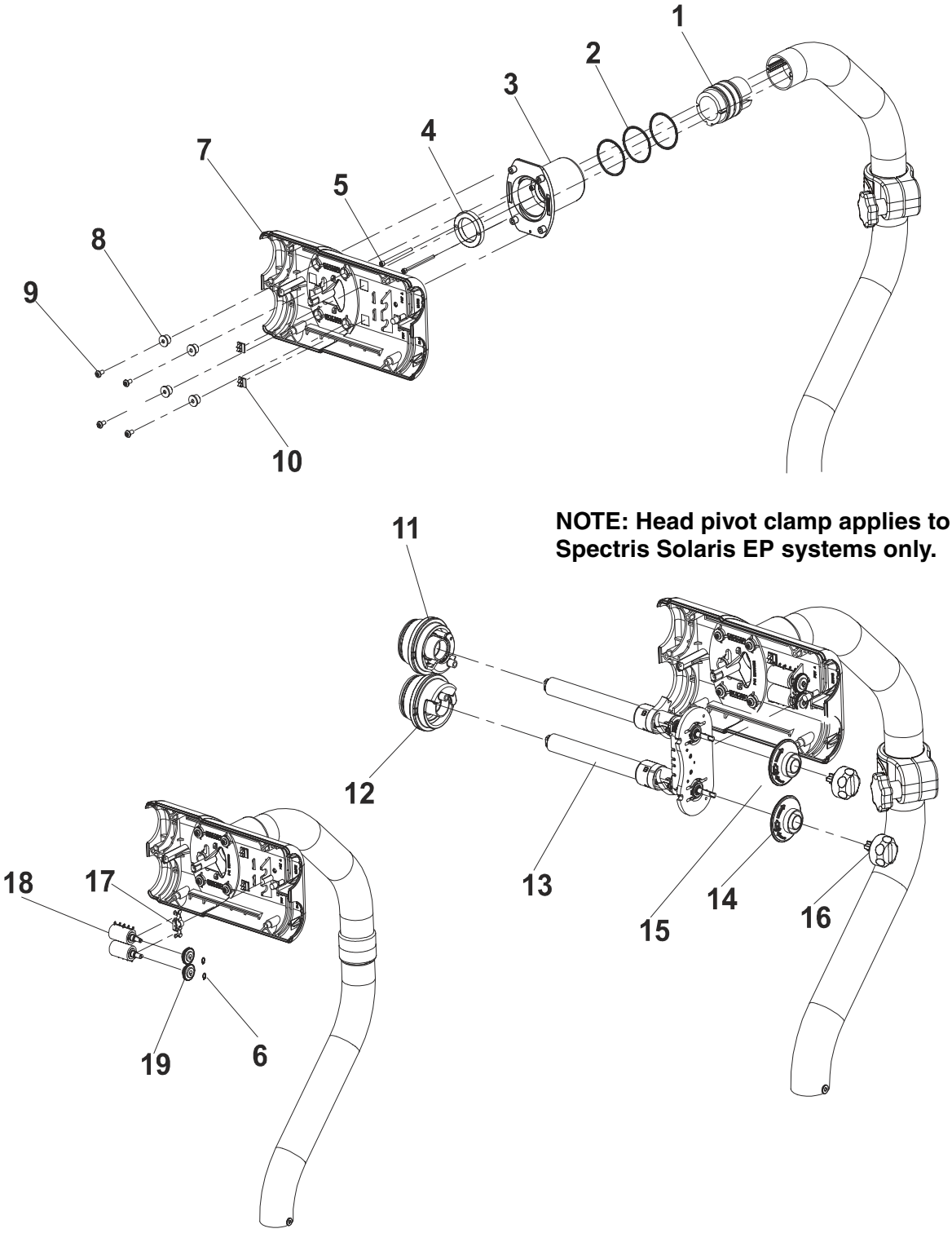
Head

Ref. No.	Part Description	Part Number	Qty.
1	Bushing, Knuckle	901001046	1
2	O-Ring	629-4134-366	3
3	Knuckle	3004271	1
4	Retainer, Pivot Head	901001066	1
5	Screw, 8-32 x 2.5”	614-0832-250	2
6	Retaining Ring	645-3100-250	2
7	Bottom Cover - Solaris EP (shielded) Bottom Cover - Solaris	3011663 3004608	1 1
8	Bushing, Rear Cover	901001135	4
9	Screw, 10-32 x .375”	602-1032-389	4
10	Cable Tie Mount	715-0301-500	2
11	Syringe Interface A	3006229	1
12	Syringe Interface B	3006230	1
13	Mechanical Drive Assembly	3005122	1
14	Lens, Blue	901001087-2	1
15	Lens, White	901001087-1	1
16	Knob	901001042	2
17	Pot Clip	3006691	1
18	Potentiometer	3006005	2
19	Gear - 44 tooth	3006692	2

Not Shown:

Hole Plug	621-3174-600	2
Flex Shaft Retainer	901001145	2
Sensor, PCB Assembly	3009969	1
Cable, Syringe Sensor A (P327 - P401)	3007597	1
Cable, Syringe Sensor B (P328 - P401)	3007599	1
Screw, 4-40 x 3/8” (for sensor PCB hold-down)	602-0440-389	2
Cable Clamp for Head Cable	(long half - 3011665) (short half - 3011664)	1



NOTE: Head pivot clamp applies to Spectris Solaris EP systems only.

Miscellaneous Accessory Parts

Part Description	*Part Number*
Start Switch	3006265
FO cable 200' 60.96m	3005255
Battery Charger Kit	SSMR BC
Battery charge (power box)	3004201
Battery bracket	3006422
Charger bracket	3006423
Power cord	
American	535-0243-012
Continental	535-0127-012
Battery Pack	901001064
Penetration panel covers kit	3010861
9 pin	412006203
15 pin	412006202
25 pin	412006201
Syringe adapter (Japan only)	
Blue adapter	3004995
Green adapter	3004998
Yellow adapter	3004997
Purple adapter	3010820
Gray adapter	3010821
Contrast Holder	CHD 100 MR
Tray	CHD 400 MR
CRU Wall Mounting Bracket	SDW 300
Continuous Battery Charger	
Power Supply Unit	3009834
Battery with charger PCB	3009833
Cable 20' (6.1 m)	3009961
Cable 75' (22.9 m)	3009923
Filtered Cable	3009925
Ferrite Clamps	3010384
Mobile Mount	
Bracket	3010780
Pad	3010787
Integrated Continuous Battery Charger	3012080
Power Supply	3012637
Cable 50 ft.	3012038
Cable 20 ft.	3009961
PenPanel Interface	3009925